.541
42a
59
12A

# NUCLEAR SCIENCE ABSTRACTS

UNIVERSITY OF ILLINOIS
LIBRARY
JUL 14 1959
CHICAGO

*June 30, 1959*

Volume 13 Number 12A
Abstracts 10755–11519

**UNITED STATES ATOMIC ENERGY COMMISSION**

**Technical Information Service**

# USAEC DEPOSITORY LIBRARIES

The libraries listed below maintain collections of unclassified U. S. Atomic Energy Commission reports for reference use by the general public. These depository collections are conveniently organized, and staff members of the libraries will assist requesters in the use of the collections. All the libraries have facilities for making photocopies of reports that are not more conveniently available in printed form from the Office of Technical Services. Canadian reports in the AECL series and currently issued British reports in the AERE and IG series are also available at the Libraries listed below.

**ALABAMA**
Auburn, Alabama Polytechnic Institute Library
Birmingham, Birmingham Public Library

**ARIZONA**
Tucson, University of Arizona Library

**ARKANSAS**
Fayetteville, University of Arkansas Library

**CALIFORNIA**
Berkeley, University of California General Library
Los Angeles, University of California Library
Menlo Park, Stanford Research Institute
San Diego, San Diego Public Library

**COLORADO**
Denver, Denver Public Library

**CONNECTICUT**
New Haven, Yale University Library

**DELAWARE**
Newark, University of Delaware Library

**DISTRICT OF COLUMBIA**
Washington, Library of Congress

**FLORIDA**
Coral Gables, University of Miami Library
Gainesville, University of Florida Engineering Sciences Library

**GEORGIA**
Atlanta, Georgia Institute of Technology Library

**ILLINOIS**
Chicago, John Crerar Library
Chicago, University of Chicago Library
Evanston, Northwestern University Library
Urbana, University of Illinois Library

**INDIANA**
Indianapolis, Indianapolis Public Library
Lafayette, Purdue University Library

**IOWA**
Ames, Iowa State College Library

**KANSAS**
Manhattan, Kansas State College Library

**KENTUCKY**
Lexington, University of Kentucky Library
Louisville, University of Louisville Library

**LOUISIANA**
Baton Rouge, Louisiana State University Library
New Orleans, Tulane University Library

**MARYLAND**
Baltimore, Johns Hopkins University Library
College Park, University of Maryland Engineering and Physical Sciences Library

**MASSACHUSETTS**
Cambridge, Harvard University Library
Cambridge, Massachusetts Institute of Technology Library

**MICHIGAN**
Ann Arbor, University of Michigan Library
Detroit, Detroit Public Library

**MINNESOTA**
Minneapolis, University of Minnesota Library

**MISSOURI**
Kansas City, Linda Hall Library
Rolla, The University of Missouri School of Mines and Metallurgy Library
St. Louis, Washington University Library

**MONTANA**
Bozeman, Montana State College Library

**NEVADA**
Reno, University of Nevada Library

**NEW JERSEY**
Princeton, Princeton University Library

**NEW MEXICO**
Albuquerque, University of New Mexico Library

**NEW YORK**
Buffalo, Lockwood Memorial Library
Ithaca, Cornell University Library
New York, Atomic Industrial Forum
New York, Columbia University Library
New York, New York Public Library
Rochester, University of Rochester Library
Schenectady, Union College Library
Troy, Rensselaer Polytechnic Institute Library

**NORTH CAROLINA**
Charlotte, Charlotte and Mecklenburg County Public Library
Durham, Duke University Library
Raleigh, North Carolina State College Library

**OHIO**
Cincinnati, University of Cincinnati Library
Cleveland, Cleveland Public Library
Columbus, Ohio State University Library
Toledo, University of Toledo Library
Youngstown, Youngstown University Library

**OKLAHOMA**
Stillwater, Oklahoma State University Library

**OREGON**
Corvallis, Oregon State College Library
Portland, Reed College Library

**PENNSYLVANIA**
Philadelphia, University of Pennsylvania Library
Pittsburgh, Carnegie Library of Pittsburgh
University Park, Pennsylvania State University, Pattee Library

**PUERTO RICO**
Rio Piedras, University of Puerto Rico, Main Library

**RHODE ISLAND**
Providence, Brown University Library

**SOUTH CAROLINA**
Columbia, University of South Carolina, McKissick Memorial Library

**TENNESSEE**
Knoxville, University of Tennessee Library
Memphis, Memphis Public Library
Nashville, Joint University Libraries

**TEXAS**
Austin, University of Texas Library
College Station, Agricultural and Mechanical College of Texas Library
Dallas, Southern Methodist University Library
Houston, The Rice Institute Library
San Antonio, San Antonio Public Library

**UTAH**
Salt Lake City, University of Utah Library

**VIRGINIA**
Blacksburg, Virginia Polytechnic Institute Library
Charlottesville, University of Virginia, Alderman Library

**WASHINGTON**
Pullman, State College of Washington Library
Seattle, University of Washington Library

**WEST VIRGINIA**
Morgantown, West Virginia University Library

**WISCONSIN**
Madison, University of Wisconsin Library
Milwaukee, Milwaukee Public Library

**WYOMING**
Laramie, University of Wyoming Library

# NUCLEAR SCIENCE ABSTRACTS

A Semimonthly Publication of the United States Atomic Energy Commission Technical Information Service

## PURPOSE AND SCOPE

*Nuclear Science Abstracts (NSA)* serves scientists and engineers interested in the field of atomic energy by providing abstracts of the literature on nuclear science and engineering as well as immediate and detailed indexes to that literature.

*NSA* covers (1) research reports of the United States Atomic Energy Commission and its contractors; (2) research reports of government agencies, universities, and industrial research organizations on a world wide basis; (3) translations, patents, books, and articles appearing in technical and scientific journals.

## ARRANGEMENT OF ABSTRACTS

Abstracts included in *NSA* are arranged or grouped into a number of broad subject categories as illustrated by the table of contents. Since a subject index is now included in each issue, the categories have been reduced in number and made less specific than in previous volumes of *NSA*.

## INDEXES

### *Indexes in Individual Issues*

Each issue of *NSA* includes personal and corporate author, subject, and report number indexes. Report numbers are also indicated in the author and subject indexes. The author indexes include "short" titles of the items indexed. The Report Number Index provides information on the availability of the reports.

### *Cumulated Indexes*

The indexes included in the individual issues are cumulated quarterly, semiannually, and annually. A cumulated report number, author, and subject index covering Vols. 1 through 4 (July 1948–1950) is included in the bound Vol. 4 which is available from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. ($6.00). A subject and author index covering Vols. 5 through 10 (1951–1956) is also available from the Superintendent of Documents ($5.25).

A cumulated report number index to *NSA* through Vol. 11 (1957) and to its predecessor, *Abstracts of Declassified Documents*, has been issued separately as report TID-4000, 3rd. Ed., *Availability List of USAEC Reports*. This report is available from the Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C. ($3.00).

## AVAILABILITY OF *NSA*

### *Sale*

*NSA* is available on subscription from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., at $18.00 per year for the semimonthly abstract issues and $15.00 per year for the four cumulated-index issues. Subscriptions are postpaid within the United States, its Territories, Canada, Mexico, and all Central and South American countries except Argentina, Brazil, British and French Guiana, Surinam, and British Honduras. Subscribers in these Central and South American countries, and in all other countries throughout the world, should remit $22.50 per year for subscriptions to semimonthly abstract issues and $17.50 per year for the four cumulated-index issues.

### *Exchange*

*NSA* is also available on an exchange basis to universities, research institutions, industrial firms, and publishers of scientific information. Inquiries should be directed to the Technical Information Service Extension, U. S. Atomic Energy Commission, P. O. Box 62, Oak Ridge, Tennessee.

## AVAILABILITY OF PUBLICATIONS ABSTRACTED

Journal articles, books, and other privately published materials are not available from the AEC. Detailed information on obtaining reports and translations is given in the introduction to the Report Number Index.

### *U. S. Patents*

Copies of U. S. patents may be ordered from the U. S. Patent Office, Department of Commerce, Washington 25, D. C. ($0.25 per copy).

### *United Kingdom Patents*

Copies of United Kingdom patents may be ordered from The Patent Office, 25, Southampton Buildings, London W.C.2, England ($0.49 per copy).

*Use of funds for printing this publication approved by the Director of the Bureau of the Budget February 3, 1959.*

# CONTENTS

Volume 13, Number 12A, June 30, 1959

| Category | Abstract | Page |
|---|---|---|
| GENERAL | 10755 | 1447 |
| BIOLOGY AND MEDICINE | 10763 | 1448 |
| CHEMISTRY | | |
| General | 10822 | 1457 |
| Radiation and Radiochemistry | 10951 | 1474 |
| Separation Processes for Pu and U | 10972 | 1476 |
| CONTROLLED THERMONUCLEAR PROCESSES | 10993 | 1480 |
| CRITICALITY STUDIES | 11001 | 1481 |
| GEOLOGY AND MINERALOGY | 11002 | 1481 |
| HEALTH AND SAFETY | 11016 | 1483 |
| INSTRUMENTS | 11082 | 1492 |
| METALLURGY AND CERAMICS | 11158 | 1500 |
| PARTICLE ACCELERATORS AND HIGH-VOLTAGE MACHINES | 11243 | 1510 |
| PHYSICS AND MATHEMATICS | | |
| General | 11255 | 1512 |
| PHYSICS AND MATHEMATICS (Cont'd.) | | |
| Elementary Particles | 11345 | 1523 |
| Heat Transfer and Fluid Flow | 11363 | 1525 |
| Nuclear Properties and Reactions | 11375 | 1527 |
| Theory | 11403 | 1530 |
| RADIATION EFFECTS ON MATERIALS | 11416 | 1532 |
| RADIOACTIVE WASTE | 11435 | 1536 |
| REACTORS | | |
| General | 11441 | 1537 |
| Power | 11480 | 1542 |
| TECHNOLOGY | | |
| Feed Materials | 11515 | 1547 |
| Raw Materials | 11516 | 1547 |
| CORPORATE AUTHOR INDEX | | INDEX-1 |
| PERSONAL AUTHOR INDEX | | INDEX-7 |
| REPORT NUMBER INDEX | | INDEX-30 |
| SUBJECT INDEX | | INDEX-37 |

## Legal Notice

The AEC reports listed in this document are accounts of Government sponsored work. Neither the United States, nor the Commission, nor any person acting on behalf of the Commission:

A. Makes any warranty or representation, expressed or implied, with respect to the accuracy, completeness, or usefulness of the information contained in this report, or that the use of any information, apparatus, method, or process disclosed in this report may not infringe privately owned rights; or

B. Assumes any liabilities with respect to the use of, or for damages resulting from the use of any information, apparatus, method, or process disclosed in this report.

As used in the above, "person acting on behalf of the Commission" includes any employee or contractor of the Commission, or employee of such contractor, to the extent that such employee or contractor of the Commission, or employee of such contractor prepares, disseminates, or provides access to, any information pursuant to his employment or contract with the Commission, or his employment with such contractor.

# NUCLEAR SCIENCE ABSTRACTS

Volume 13 Number 12A June 30, 1959

## GENERAL

**10755** AECU-4039
Holmes and Narver, Inc., Los Angeles.
COMPLETION REPORT, PROJECT CHARIOT—PHASE I—OPERATION PLOWSHARE. 1958. 53p. Contract AT(29-2)-20. (HN-111-942). $10.80(ph), $3.90(mf) OTS.

Preliminary surveys and site investigations are reported for a project that would demonstrate the application of a nuclear blast to produce a harbor. The project has as a final goal the excavation of a harbor on the northwest coast of Alaska, a short distance south of Point Hope. The harbor was planned to be approximately one thousand yards wide and two thousand yards long, with a 400-yard channel leading to the Chuckchee Sea. (C.H.)

**10756** UCRL-5458
California. Univ., Livermore. Lawrence Radiation Lab.
MINERAL RESOURCE DEVELOPMENT BY THE USE OF NUCLEAR EXPLOSIVES. Gerald W. Johnson. Feb. 5, 1959. 18p. Contract W-7405-eng-48. $0.50 (OTS).

Presented at the convention of the American Institute of Mining and Metallurgical Engineers, February 17, 1959, San Francisco.

All of the experience with the pertinent effects of nuclear explosives has been obtained in conjunction with weapons development and testing. The results that are presently available and how they might be employed in problems of mineral exploitation are described. (W.L.H.)

**10757**
ANALYSIS OF THE GAMMA ACTIVITY IN ATMOSPHERIC DUST PARTICLES. A. Scafati (Istituto Superiore di Sanità, Rome). Minerva nucleare 3, 16-20(1959) Jan. (In Italian)

The results of a study of the atmospheric radioactivity by means of the determination of the $\gamma$ activity of dust collected on filter paper and measured with a scintillation spectrometer are presented. The advantages and limitations of this method are discussed from the standpoint of detection of fission products. (auth)

**10758**
NUCLEAR EXPLOSIONS IN SPACE. [PART 3]. S. Fred Singer (Univ. of Maryland, College Park). Missiles and Rockets 5, No. 15, 21-4; 41(1959) Apr. 13.

The effects of nuclear explosion in space on radio communication, radar, and long-range detection and guidance gear are discussed. (W.L.H.)

**10759**
NUCLEAR EXPLOSIONS IN SPACE. [PART 4.] S. Fred Singer (Univ. of Maryland, College Park). Missiles and Rockets 5, No. 16, 26; 28-30(1959) Apr. 20.

The nature and origin of the earth's radiation belts are discussed and the possibility of sweeping the inner one out with an absorbing satellite is examined. The measuring of various phenomena in these belts and the inspection of atomic explosions in space are discussed. (T.R.H.)

**10760**
THE DEPOSITION OF STRONTIUM-90 ON THE EARTH'S SURFACE. Hans Kiefer and Rupprecht Maushart (Kernreaktor-Bau-und Betriebs-GmbH., Karlsruhe, Ger.). Naturwissenschaften 46, 102-4 (1959). (In German)

The origin of fall-out and the special role of $Sr^{90}$ among the fission products are briefly considered, and previously published results of the measurement of $Sr^{90}$ on the earth's surface are reviewed. The $Sr^{90}$ accumulation in 1958 in the Karlsruhe—Bruchsal—Pforzheim area was determined, and the results are tabulated. The average value of the $Sr^{90}$ content accumulated up to May 1958 was 11.8 $mc/km^2$. The English estimation at the end of 1957 was 9 $mc/km^2$. (J.S.R.)

**10761**
NUCLEAR GRAPHITE PRODUCTION. Nuclear Eng. 4, 175-8(1959) Apr.

Anglo Great Lakes Corporation's new factory for nuclear grade graphite production at Newburn Haugh, Newcastle upon Tyne, is described. The various steps in the manufacturing process are explained. The plant is designed for an annual production of up to 10,000 tons of moderator bricks for nuclear reactors and 5,000 tons of graphite for electrodes. (W.D.M.)

**10762**
THE ATOM AND THE ENERGY REVOLUTION. Norman Lansdell. New York, Philosophical Library, 1958. 196p.

The first section of this volume discusses the world energy resources and demand. The second section describes new sources of energy: wind power, water power, vegetable resources, solar energy, electrochemical, and direct conversion of radiation into electrical current. In the third section the atom and its energy is discussed from the historical through structure and energy. The fourth section is devoted to methods of releasing atomic energy. Section five describes sources of natural materials for atomic energy development. Section six discusses various applications of atomic energy. Section seven describes political and commercial organizations for atomic energy development. The last section discusses radiation risks and insurance against them. (W.L.H.)

## BIOLOGY AND MEDICINE

**10763** AERE-Med/R-1579
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
BLOOD COUNT LEVELS AT A.E.R.E. IN RELATION TO RADIATION DOSAGE. Frances M. Turner. Dec. 13, 1954. 10p.

Comparison of the blood counts of groups of workers exposed to varying levels of radiation between the periods 1947 to 1950 and 1951 to 1954 gives no evidence of radiation effects on the mean counts of the groups. (auth)

**10764** AERE-Med/R-1582
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
A COMPARISON OF THREE METHODS OF MAKING DIFFERENTIAL WHITE CELL COUNTS. Frances M. Turner, C. Sanders, and P. C. C. Long. Dec. 1954. 10p.

Three methods of making differential white cell counts are compared. Statistical analysis of the results shows that the ratio of granulocytes to mononuclear cells is slightly higher in the counts made from a wet preparation in a hemacytometer, than from either a hand spread or machine spread film. It is recommended that, when speed of operation is of importance, the method of making differential counts direct from a hemacytometer should be adopted. (auth)

**10765** AF-SAM-58-142
Texas. Univ., Austin.
THE EFFECTS OF IONIZING RADIATION UPON THE TRANSPOSITION OF DISCRIMINATION HABITS OF RHESUS MONKEYS. George Gentry, W. Lynn Brown, and John E. Overall. June 20, 1958. 6p.

Thirty-three rhesus monkeys, representing five radiation dose levels, were trained on intermediate-size discrimination problems. A test of transposition was employed to determine the extent to which subjects of the different dose groups utilized relationships between the stimuli as a basis for problem solution. Relational learning was found to decrease as a linear function of radiation dosage. (auth)

**10766** AF-SAM-58-149
Texas. Univ., Austin.
VISUAL ACUITY PERFORMANCE OF NORMAL AND CHRONIC IRRADIATED MONKEYS. W. Lynn Brown and A. A. McDowell. June 24, 1958. 5p.

Six normal, 10 low-dose irradiated (77 to 154 rep), 9 intermediate-dose irradiated (308 rep), and 4 high-dose irradiated rhesus monkeys (616 rep) were tested to a criterion of 21 correct responses (24 trials a day) for two successive days on each of eight visual acuity problems presented in order of increasing difficulty. Each problem required the subject to choose between circles and circles with breaks in order to procure a food reward. Previous visual acuity testing had shown a deficit only in the high-dose irradiated group during the first year following the radiation exposure to which the experimental animals had been subjected three years prior to the initiation of the present study. The results of the present study demonstrated that the visual acuity deficit noted during the first year after exposure in the high-dose irradiated monkeys (616 rep) was still manifested three years after exposure, monkeys in the intermediate-dose group (308 rep), that had shown no visual acuity deficit during the first year after exposure, manifested such a deficit three years after exposure. An interpretation of the results in terms of a basic deficit in learning ability for the monkeys of these two groups is contraindicated by their superiority over normal and low-dose irradiated monkeys on the initial and easiest problem. (auth)

**10767** AF-SAM-59-1
School of Aviation Medicine, Randolph AFB, Tex.
TOXICOLOGIC STUDIES WITH DIDYMIUM NITRATE AS MODIFIED BY SITE OF INJECTION AND WHOLE-BODY RADIATION. George S. Melville, Jr., Thomas P. Leffingwell, and Quentin L. Hartwig. July 2, 1958. 8p.

The rare-earth mixture didymium (as the nitrate) was administered to rats intraperitoneally, subcutaneously, and in wound implantation. Mortality and clinical sequelae were observed. When groups of these animals were subjected to 800 r of $Co^{60}$ gamma irradiation, mortality was increased in all treatment groups. This increase was statistically significant in the intraperitoneal experiment and the combined effect appears to be synergistic. (auth)

**10768** AF-SAM-59-5
Texas. Univ., Austin.
VISUAL ACUITY PERFORMANCE OF NORMAL AND CHRONIC FOCAL-HEAD IRRADIATED MONKEYS. A. A. McDowell and W. Lynn Brown. July 10, 1958. 5p.

Monkeys were tested on each of eight visual acuity problems presented in order of increasing difficulty. The results of the study reflected differences between chronic focal-head irradiated monkeys and normal monkeys with respect to performance on these problems. Most efficient performance was shown by the control animals, intermediate efficiency of performance by the animals with previous focal-head irradiation of the posterior association areas, and least proficient performance by the animals with previous focal-head irradiation of the frontal association areas. (auth)

**10769** AF-SAM-59-17
Oak Ridge National Lab., Tenn.
STUDIES ON THE MECHANISM OF LEUKEMOGENESIS BY IONIZING RADIATION. A. C. Upton. Aug. 5, 1958. 14p.

The induction of leukemia by ionizing radiation is influenced by many variables, including radiation intensity, radiation dose, fraction of the body irradiated, genetic differences in susceptibility, age at irradiation, sex, and other physiologic factors. The influence of these variables on the induction of leukemia varies with the hematologic type of leukemia induced. Irradiation increases the susceptibility of adult mice to filterable leukemogenic agents that, administered after irradiation, enhance the development of leukemia. (auth)

**10770** AF-SAM-59-52
School of Aviation Medicine, Randolph AFB, Tex.
EFFECT OF REPEATED WHOLE-BODY X-IRRADIATION ON THE PERIPHERAL WHITE BLOOD CELL COUNT OF RABBITS. Herbert G. Gerstner and Harry A. Gorman. Dec. 9, 1958. 6p.

Six groups of rabbits received whole-body x irradiation of 0, 100, 200, 300, 400, and 500 r, respectively. Counts of total white blood cells were performed regularly until 11 weeks postexposure when radiation-induced leukopenia had disappeared in all groups. At that time, the animals were re-exposed to the same doses, and white cells were once more counted throughout 11 weeks. Then followed a third application of the same doses with subsequent observation of white counts. Statistical analysis of data yielded the following results: In the three exposures, radiation-induced leukopenia showed no significant difference with respect to rate of development, maximal degree, and rate of disappearance. Therefore, as judged by the white blood cell count, susceptibility to ionizing radiation appeared unaltered by previous exposure to appreciable doses when the interval between exposures was sufficiently long to permit complete hematopoietic recovery. (auth)

**10771** AMRL-375
Army Medical Research Lab., Fort Knox, Ky.
EFFECT OF GLYCINE ON SURVIVAL OF X-IRRADIATED MICE. Anthony J. Luzzio, Thomas J. Johanson, and James G. Kereiakes. Oct. 23, 1958. 9p. Project No. 6-59-08-014.

Survival of mice exposed to 650-r whole-body x irradiation was increased 25% by a single pre-irradiation injected dose of 50 mg glycine. Post-treatment with glycine, either single or multiple injection doses, did not affect survival. In view of the large glycine doses required, it can only be concluded at present that the limited protection afforded by glycine is due to a nonspecific affect. (auth)

**10772** BNL-3306
Brookhaven National Lab., Upton, N. Y.
MEDICAL MISSION TO MARSHALL ISLANDS. Leo M. Meyer. [July 12, 1957]. 5p. $1.80(ph), $1.80(mf) OTS.

An account is presented of the activities of the medical team during the third annual medical survey of Marshall Island natives exposed to radioactive fall-out in March 1954. No technical data are included. (C.H.)

**10773** LA-2296
Los Alamos Scientific Lab., N. Mex.
GAMMA RADIOACTIVITY OF PEOPLE AND MILK—TABULATION OF 1958 RESULTS OF THE LAST HUMAN COUNTER PROGRAM. E. C. Anderson, B. Clinton, and J. L. Shields. Jan. 1959. 186p. Contract W-7405-eng-36. $3.00(OTS).

Tabular and graphical summaries are given for 3027 determinations of potassium (by means of the natural radioactivity of $K^{40}$) and of the fission product $Cs^{137}$ in people and in milk. Determinations were made by gamma ray spectrometry using a large $4\pi$ liquid scintillation counter. Results of repeated control measurements and statistical analyses of the precision of the results are given. Computational methods are outlined, and the complete program for electronic data processing is listed. (auth)

**10774** NM-007-081.03.07
Naval Medical Research Inst., Bethesda, Md.
THERMAL RADIATION BURNS IN RABBITS. VI. THE EFFECT OF THE IMMEDIATE APPLICATION OF COLD TO "FLASH"-TYPE BURNS ON SEVERITY AS MEASURED BY RADIOACTIVE PHOSPHORUS UPTAKE. Carleton McKenzie Neil. Jan. 21, 1958. 10p.

This experiment was performed to determine whether the application of cold immediately after burning has a beneficial effect in reducing the severity of burns as measured by $P^{32}$ uptake in the burned tissue. Eighteen, young adult, albino rabbits under ether anesthesia were subjected to radiant energy, flash-type burns of both ears in such a manner as to produce equal severity burns on any one animal. The burn source was a focused group of 43 photolamps delivering 5.5 $cal/sec^{-1}/cm^{-2}$ at the aperture. Two series of exposures (0.8 and 1.1 sec) of nine rabbits each were used. One ear of each rabbit was cooled by covering it on both sides with ice-filled plastic bags within 10 seconds of burning. Approximately 10 minutes after burning each rabbit was given intracardially an aqueous solution of radioactive phosphorus (65 microcuries $P^{32}$ kg body weight). Determinations of the radioactivity in each burn were made daily for the first 5 days using in vivo surface counting methods. Statistical analysis of the data was based on the percentage difference of mean radioactivity of treated and untreated burns, and a determination of the error of difference (ED) due to instrumentation and biological variability (20 percent). Where the ED was greater than 20 percent for any pair of burns a difference in severity is presumed to exist. It was found that 3 of 17 rabbits (18 percent) showed a decrease in burn severity when the burns were so cooled. No instances of increased severity were noted. There was one anesthetic death. It was, therefore, concluded that about one in five might be benefitted by local cooling under optimum conditions, but that no harm is to be expected. (auth)

**10775** NM-007-081.03.08
Naval Medical Research Inst., Bethesda, Md.
THERMAL RADIATION BURNS IN RABBITS. IV. THE DISTRIBUTION OF PHOSPHORUS AND RADIOPHOSPHORUS ($P^{32}$) FRACTIONS IN FLASH-TYPE BURNS OF THE RABBIT EAR. G. W. Imirie and C. M. Neil. Nov. 6, 1958. 14p.

Colorimetric and radiometric determinations of acid-soluble (AS), phospholipid (PL), and total phosphorus (TP) were done at 1, 7, 14, and 21 days after burning to determine which fraction produced the characteristic accumulation of radioactive phosphorus ($P^{32}$) in flash-type, thermal radiation burns of the rabbit ear. The implications of this experimental work are suggestive of trends and not conclusive due to large individual variations and small numbers of determinations per sample. Blood phosphorus fractions, both radiometrically and colorimetrically determined, may follow a time course consistent with a burn too small to produce a systemic reaction. Radioactivity determined by surface counts in vivo appeared to correlate positively to a significant degree with TP radioactivity determined by chemical analysis. It was calculated by extrapolation on the basis of TP content of this standard burn, that a 50% area burn in a rabbit might accumulate an amount of TP approximately equal to the total in the blood. This suggests that large scale localization of TP at the burn, which might remove it from the general body metabolism, may be a factor in the unexplained late deaths of severe burns. Shifts in metabolites other than phosphorus compounds after a burn ought to be investigated. The use of phosphate compounds in burn therapy is a further subject for study. (auth)

**10776** ORO-183
Tennessee. Univ., Knoxville. Agricultural Research Lab.
SEMI-ANNUAL PROGRESS REPORT FOR JULY 1, 1958 TO DECEMBER 31, 1958. 45p. $1.25(OTS).

The gamma irradiation facility for the exposure of seed and plant materials was modified. The entire table was modified to rotate around the source, with individual turntables placed in concentric circles to rotate on their own axes. Sixty-nine samples were irradiated during the period. Results are tabulated from field, greenhouse, and laboratory studies on the radiosensitivity of plant materials and seed. Studies were continued on the metabolism of fission products in farm animals. Data are presented on the deposition of barium-133, calcium-45, and strontium-89 in the shell and yolks of eggs, and in chick embryos following administration to hens. Milk from cows dosed orally with strontium-89 was treated with 0.02% rennet at 88°F. Samples of curd and whey were taken at cutting, draining, and milling times. The data which show the concentration of the isotope in the curd become greater as water is expelled. The concentration of strontium-89 in the curd at milling time was nearly five times that at cutting time. An isotopic dilution process was found to be more efficient than straight ion exchange to separate radioactive nuclides from whole milk samples. Data are included from studies on the relation of strontium-89 and calcium-45 metabolism in dairy cattle. Other studies reported in progress include mineral metabolism in farm animals and radiation effects on reproductive functions in farm animals. Data are tabulated on the lethal effects of cobalt-60 gamma irradiation of the head in burros. Following exposure to 2000 rad, symptoms of central nervous system involvement were observed within 5 hours, followed by death in less than 24 hours. Hematological examination indicated an immediate neutrophilic leukocytosis and an increase in blood sugar. Necroscopy examination revealed changes in the central nervous system consisting of hemorrhage, plasmatic extravasation, and perivascular neutrophilic infiltration. Massive subarachnoid hemorrhage was observed in animals receiving more than 256 rad to the brain. Preliminary evaluation of the data indicates the rate at which irradiation is administered is directly related to the incidence of early mortality. A list of publications during the period is included. (For preceding period see ORO-177.) (C.H.)

**10777** ORO-194
Tulane Univ., New Orleans.
TRANSPORT AND METABOLISM OF LIPIDS. Final Scientific Report [for] June 29, 1951 to February 28, 1959. Mar. 9, 1959. 22p. Contract AT(40-1)-1302. $4.80(ph), $2.70(mf) OTS.

Results are summarized from studies of serum lipids, with particular reference to physiological and pathological influences which modify the ultracentrifugal pattern. Some data from paper electrophoretic studies were correlated with those of chemical analysis of ultracentrifugal fractions. An improved technique is described of comparing traces of strips stained for lipid. (C.H.)

**10778** UCRL-8573
California. Univ., Berkeley. Lawrence Radiation Lab.
A STUDY OF THE EFFECTS OF ELEVATED TEMPERATURES ON THE GROWTH AND INHERITANCE OF *SACCHAROMYCES CEREVISIAE* (thesis). Freddie Sherman. Nov. 1958. 67p. Contract W-7405-eng-48. $1.75(OTS).

A comparative study was made of the growth of yeast in various media at the optimum temperature (30°) and at supraoptimum temperatures. It was found that at elevated temperatures there is a decrease in the ability of yeast to grow, which may be alleviated by increasing the percentage of yeast extract in the medium, adding oleic acid to the medium, or using an inoculum of cells that have previously been grown at the elevated temperature. Because of these findings, it is believed that growth at elevated temperatures results in an increased nutrient requirement which may be eliminated by induced adaptation. When yeasts were grown at elevated temperatures or exposed for a short time to lethal temperatures it was found that there was a great increase in the fraction of respiratory-deficient mutants (petites). It was shown that the increase of mutants did not arise because of selection, but that the elevated temperatures actually induced the mutation. From the results of various genetic analyses it is shown that these respiratory-deficient mutants are very similar, if not identical, to vegetative petites occurring spontaneously or induced by acriflavine. The kinetics of this mutation is discussed, with possible theoretical interpretations. (auth)

**10779** UR-540
Rochester, N. Y. Univ. Atomic Energy Project.
AUTORADIOGRAPHIC STUDY OF LUNG CLEARANCE AND DISTRIBUTION OF POLONIUM-210 AFTER INTRATRACHEAL INJECTION. Louis J. Casarett and Paul E. Morrow. Jan. 14, 1959. 24p. Contract W-7401-eng-49. $4.80(ph), $2.70(mf) OTS.

Autoradiographic observations are reported on lung, liver, spleen, and kidney of rabbits at time intervals of 1 to 30 days after intratracheal injection of polonium-210 radiocolloid and silver particles on which polonium-210 has been adsorbed. Quantitatively, the rate of clearance from the lung of the polonium on silver particles was slightly faster (4.5 versus 5 days half-time). Qualitatively, the processes by which the particles are removed from the lung are identical. The silver particles appeared to be phagocytized more rapidly and were transported to lymphoid tissue earlier and to greater extent than were polonium radiocolloidal particles. Some observations suggest the entry of radiocolloids directly into the circulation while the primary route of removal from the lung was via the ciliated epithelium into the gastrointestinal tract. Solubilization of the radiocolloids occurred during the 30 day period, especially rapidly in macrophages and in lymphoid tissue. The observations are discussed with emphasis on the mechanism of transport of particles and the significance of these processes in the distribution of the radiation dose. (auth)

**10780** USNRDL-TR-293
Naval Radiological Defense Lab., San Francisco.
THE EFFECTS OF TOTAL BODY IRRADIATION OF DOGS WITH SIMULATED FISSION NEUTRONS. E. L. Alpen, O. S. Shill, and E. Tochilin. Dec. 16, 1958. 26p.

Mongrel male dogs were exposed to neutrons obtained by bombarding a thick Be target with 12 Mev protons. The distribution of neutron and associated gamma-ray dose was measured throughout the volume of a tissue equivalent phantom constructed to simulate an average dog. The median lethal midline tissue dose is 239 rads, of which 165 rads are from neutrons and 74 rads are from gamma rays. The potency ratio, compared with

250 kvp x rays is approximately 0.9, in good agreement with the value of 0.95 found by other workers with a higher energy neutron beam. The significance of this potency ratio in terms of the gastrointestinal and bone marrow injuring potential of neutrons is discussed, and the idea is presented that death after neutron irradiation of dogs is almost purely the result of bone marrow injury while death in rodents is the result largely of injury to the gastrointestinal tract. (auth)

**10781** USNRDL-TR-296
Naval Radiological Defense Lab., San Francisco.
LETHAL GRAFT VERSUS HOST REACTION INDUCED IN X-IRRADIATED $F_1$ HYBRIDS BY PARENTAL STRAIN LEUKOCYTES. L. J. Cole, R. M. Garver, and J. P. OKunewick. Feb. 10, 1959. 11p.

The experimental findings show that the injection of parental strain (A or L strain) whole blood, containing $15 \times 10^6$ nucleated cells, into sublethally x-irradiated (500 r) $LAf_1$ mice, results in delayed deaths, i.e., from 8 to 39 days post irradiation. The general appearance of these injected mice, their body weight loss, and the histological evidence as specific lymphoid tissue atrophy indicate that the syndrome produced is entirely analogous to that observed previously following spleen cell injection. The effect is referable to the leukocytes and not to the erythrocytes or serum. Since lymph node cells, as well as spleen cells elicit these delayed deaths, it is reasonable to postulate that the responsible cells are those of the lymphoid series. These results imply that peripheral blood contains immunologically competent cells. On this basis, it is suggested that the administration of whole blood or agranulocytic leukocytes from non-isologous donors to heavily irradiated recipients constitutes a potentially hazardous procedure. (auth)

**10782** USNRDL-TR-297
Naval Radiological Defense Lab., San Francisco.
STUDIES ON TRANSFER OF ANTIBODY FORMATION BY ISO- AND HETERO-TRANSPLANTS. P. H. Chin and M. S. Silverman. Feb. 9, 1959. 23p.

An in vivo antigen-antibody reaction has been implicated as the cause of secondary or late deaths in lethally irradiated mice treated with genetically foreign bone marrow. Whether the host initiates an immunological reaction against the foreign graft or vice versa remains to be clarified. Although both mechanisms appear possible, direct immunological evidence in support of either or both mechanisms is still lacking. The injection of spleen cells from immunized rats into lethally irradiated mice resulted in the transfer of antibody synthesis. The antibody formed was shown by serological means to be rat gamma globulin. Absence of antibody production was observed following transplantation of bone marrow from the same donors. This is the first successful report of the transfer of antibody formation between donors and recipients of different species. Studies with isologous cell transfers gave similar findings. Continued and prolonged antibody synthesis was observed upon transfer of spleen cells from immunized mice into normal and irradiated isologous recipients. Transfer of bone marrow from the same immunized donors did not result in the production of measurable amounts of circulating antibodies. The results suggest that a graft vs. host reaction is possible if lymphoid tissues are transplanted. However, support for a similar reaction following transplantation of rat bone marrow was not indicated. (auth)

**10783** USNRDL-TR-299
Naval Radiological Defense Lab., San Francisco.
GASTROINTESTINAL FUNCTION DURING EXPOSURE TO X-RAYS. D. C. Jones and D. J. Kimeldorf. Feb. 18, 1959. 22p.

Several aspects of gastrointestinal function in the intact rat during exposure to x radiation were investigated. Intragastric intubation of a test meal (2 ml of 50% gum acacia) immediately before exposure or sham-exposure and determination of the amount of test material present in the stomach at the end of exposure was used to measure gastric transit during irradiation (25r/min for 1 to 20 minutes). Gastric transit appears to be an exponential process, and the effect of irradiation during the transit interval is to decrease the rate of transit by a factor of at least 3, with no discernible latent period or threshold dose. In adrenalectomized animals gastric transit is much more rapid and irradiation does not decrease the rate of transit appreciably. Gastric motility during exposure was studied in the intact rat by means of an intragastric balloon technique. Radiation exposure at 115r/min depressed gastric motility within a few minutes of the onset of radiation and the duration of effect was related to the exposure time. Intestinal function during irradiation was evaluated by observing the transit of a charcoal-gum acacia test meal through the small intestine during exposure to 50r/min of x rays. Intestinal transit during exposure was found to be unaffected by radiation, in contrast to the marked alterations observed in gastric function. (auth)

**10784** USNRDL-TR-300
Naval Radiological Defense Lab., San Francisco.
OBSERVATIONS ON REGULATION OF ERYTHROPOIESIS AND ON CELLULAR DYNAMICS BY $Fe^{59}$ AUTORADIOGRAPHY. E. L. Alpen and D. Cranmore. Feb. 18, 1959. 24p.

Iron-59 autoradiography has been utilized to measure erythrocyte maturation dynamics in normal animals and in animals subjected to severe bleeding stress. It has been shown by the parameters of erythroblast generation time, average number of cell divisions, reticulocyte maturation time, and by mitotic index that the maturation cycle is unaltered by severe bleeding stress. A hypothesis compatible with the observed data has been presented to define erythrocyte maturation regulation in the normal state and following bleeding stress. The role of erythropoietin has been discussed and also the unique advantages of $Fe^{59}$ as a autoradiographic label in erythrocyte hemodynamics. (auth)

**10785** AEC-tr-3355
STUDY OF PHAGE INDUCTION AND MULTIPLICATION IN LYSOGENIC BACTERIA. I. ON THE SURVIVAL OF LYSOGENIC E. COLI K-12 (λ) STRAIN AFTER IRRADIATION WITH ULTRAVIOLET LIGHT. Kunisuke Miki. Translated for Oak Ridge National Lab. from J. Wakayama Med. Assoc. (Japan) 6, 203-9 (1955). 32p. (Includes original, 14p.). $6.30(ph), $3.00(mf) JCL or LC.

Part II issued as AEC-tr-3524.

Reactions induced in lysogenic bacteria by exposure to ultraviolet light are reviewed. Results are presented from a study of phage induction and multiplication in lysogenic Escherichia coli. (C.H.)

**10786** AEC-tr-3541
TAGGED ATOM METHOD OF STUDYING THE BIOSYNTHESIS OF CHLOROPHYLL. (Metod Mechenych

Atomov v Izuchenii Biosinteza Chlorofilla.) A. A. Shlyk. Translated from a publication of the Publishers of Academy of Science, of Belorussiya, S.S.R., Minsk, 1956. 240p. $2.50(OTS).

The study of the biosynthesis of chlorophyll by many investigators is presented. An attempt to apply such physico-chemical methods as the method of tagged atoms and chromatography in the investigation of the chemism of the natural synthesis of chlorophyllis is presented. (W.L.H.)

**10787** AEC-tr-3573
RADIATION SICKNESS PREVENTION BY MEDICINES AND CHEMICALS. M. N. Pobedinskii (Pobedinskiy). Translated from p.53-5 of Luchevaya bolezn' (Radiation Sickness), published by the State Publishing House of Medical Literature, Moscow, 1957. 2p. $1.80(ph), $1.80(mf) JCL or LC.

It was found that substances which reduce the activity of respiratory ferments, that is, which lower oxidation processes in the organism, slow down considerably the development of radiation damages if administered to animals right before their irradiation. Such substances include, for example, cyanogen compounds. It was also determined that the exposure to lethal doses of x rays under oxygen deficiency conditions results in death of a much smaller number of animals than ordinarily. Preparations such as cysteine, glutathione, and cysteinamide likewise possess preventive characteristics with respect to radiation effects. These substances include special chemical (the so-called sulfhydryl) groups which, on combining with toxic compounds arising in the tissues under the effect of radiant energy, act as if they were drawing such compounds toward themselves and thereby preventing a disruption in the oxidation-reduction processes in the organism. While carrying on tests on animals, it was discovered that the female sex hormone when administered several days prior to irradiation (either to males or females) does have considerable protective effect. One should dwell, finally, on the question of contraindications to the prescription of certain medicinal preparations against radiation sickness. It is known that, as a result of subjecting the organism to the effect of large doses of radiation, changes occur in the hematopoietic organs, the first symptom of which is a drop in the number of white blood corpuscles. In connection therewith, persons affected by radiation sickness should not be given substances such as arsenic preparations, heavy metals, or pyramidon since they alone, without any radiation effect, bring about a drop in the number of white blood corpuscles. (auth)

**10788** AEC-tr-3580
CREATINURIA IN NON-GRAVID AND GRAVID RATS AFTER THE ACTION OF PENETRATING RADIATION. (Kreatinuriya u Neberemennykh i Beremennykh Krys Posle Vozdeistviya Pronikayuschego Izlucheniya.) Z. N. Zhakhova and A. D. Braun. Translated for Oak Ridge National Lab. from Med. Radiol. 1, No. 3, 80-5 (1956). 8p. $1.80(ph), $1.80(mf) JCL or LC.

The whole-body irradiation of rats with x rays at a dosage of 500 r produces creatinuria which increases in parallel with the severity of the clinical symptoms of radiation sickness. The level of creatinuria in rats irradiated in the final stage of pregnancy is significantly higher than in gravid rats which were irradiated on the 11th to 12th day of pregnancy. A sharp increase in creatinuria is observed in irradiated rats on the day of delivery. (auth)

**10789** AEC-tr-3603
ACTION OF IONIZING RADIATIONS ON THE COURSE OF PREGNANCY AND ON THE FETUS. V. V. Kholin. Translated from Klin. Med. (U.S.S.R.) 33, No. 6, 24-7 (1955). 4p. $1.80(ph), $1.80(mf) JCL or LC.

Results are summarized from a number of studies on the effects of ionizing radiations on the course of pregnancy and on the fetus. Disturbances of pregnancy during various stages are described. It was concluded that the occurrence of concrete anomalies of development under the influence of radiations is characteristic for various stages of the formation of the fetus. The doses which cause abnormalities of development during the period most characteristic for their occurrence differ with the anomalies. Results are included from a study of the tissue distribution of strontium-89 and plutonium in the developing fetus. Considerable concentration of strontium was found to occur in the fetus, where its accumulation was greater than in the mother. Plutonium was retained primarily in the mother. (C.H.)

**10790** AEC-tr-3604
RADIOACTIVE IODINE THERAPY OF THYROTOXICOSIS PATIENTS. G. F. Blagman, B. A. Dymshits, N. A. Gracheva, and V. S. Zudin. Translated from Klin. Med. (U.S.S.R.) 33, No. 6, 37-40(1955). 5p. $1.80(ph), $1.80(mf) JCL or LC.

Clinical results are summarized for a group of patients treated for thyrotoxicosis with radioactive iodine. Beneficial results were noted in most cases. A definite relationship was observed between the seriousness of the sickness and the results of therapy. In selecting the dose, it was considered sufficient to take into account the seriousness of the sickness and the degree of enlargement of the thyroid gland. Doses of between 1 and 6.5 mc were used with the more frequently used doses ranging from 3 to 6 mc. A single dose was sufficient in most cases. (C.H.)

**10791** AEC-tr-3605
THE EFFECT OF IONIZING RADIATIONS ON ERYTHROCYTE HEMOLYSIS. A. P. Belousov. Translated from Vestnik Rentgenol. i Radiol. 32, No. 3, 5-14(1957), 16p. $3.30(ph), $2.40(mf) JCL or LC.

Results are reported from a study of the process of chemical hemolysis of erythrocytes irradiated in vitro and in blood from irradiated animals. Data are presented which indicate chemical hemolysis in the first few hours after irradiation of animals is to some degree conditioned by the direct influence of radiation on the erythrocytes, and particularly, on their lipid fractions. Subsequent decomposition of erythrocytes is conditioned by the influence of tissue hemolysins and toxic products which arise as a result of the action of ionizing radiation as well as from associated factors. Associated afflictions, such as burns, cause an increased decomposition. The method of saponin hemolysis of erythrocytes was found to be a very sensitive test for determining the resistance of erythrocytes. (C.H.)

**10792** AEC-tr-3606
THE ADMINISTRATION OF DRUGS FOR THE CLINICAL AND EXPERIMENTAL THERAPY AND PROPHYLAXIS OF CUTANEOUS RADIATION INJURIES. N. P. Mordvinova, I. B. Tsybul'skii (Tsybul'skiy) and N. N. Garvei (Garvey). Translated from Vestnik Rentgenol.

i Radiol. 32, No. 3, 14-18(1957). 8p. $1.80(ph), $1.80 (mf) JCL or LC.

Thesane emulsion was found to be an effective therapeutic agent for treating radiation injuries of the skin. A single application of thesane emulsion did not exert any prophylactic effect, but daily use of thesane emulsion permitted increasing the dose of radiation therapy of malignant tumors. (C.H.)

**10793** AEC-tr-3610
THE MAIN PROBLEMS OF RADIATION TRAUMA. A. A. Bagdasarov and V. S. Minasov. Translated from Vestnik Akad. Med. Nauk S.S.S.R., 12, No. 4, 39-45 (1957). 15p. $3.30(ph), $2.40(mf) JCL or LC.

Results are summarized from recent studies on the pathological effects of radiation, with particular reference to the nervous system. (C.H.)

**10794** AEC-tr-3611
EFFECT OF ANESTHESIA AND NATURAL HIBERNATION ON RADIOSENSITIVITY IN ANIMALS. M. D. Pomerantseva. Translated from Zhur. Obshchei. Biol. 18, 194-207(1957). 23p. $4.80(ph), $2.70(mf) JCL or LC.

A study was made on the effects of anesthesia on radiosensitivity in mice and the effects of hibernation on radiosensitivity in ground squirrels. It was concluded that the use of nembutal, sodium amytal, and other anesthetics during irradiation increases the resistance of mice to the effects of x radiation. This is expressed in the increase of survival rate among irradiated animals, the postponement of death, and more rapid recovery of body weight. The use of hedonal and urethane anesthesia had little effect on radiosensitivity. A detailed study of the protective effect of sodium nembutal, when used as a preventive at different times and doses, showed that the protective effect is linked with a reduction in oxygen requirement of the mice. Deep nembutal anesthesia delayed early body reactions to irradiation until waking. Natural hibernation did not increase the resistance of ground squirrels to lethal doses of x radiation, but it delayed the acute course of radiation sickness until the animals awoke. The data indicate a marked influence of the central nervous system on the radiation syndrome. (C.H.)

**10795** AEC-tr-3612
REGENERATIVE PROCESSES OF BONE MARROW BLOOD PRODUCTION IN ACUTE RADIATION SICKNESS. E. (Ye.) V. Shamshina, N. V. Nikolaeva (Nikolayeva), and B. F. Belyaeva (Belyayeva). Translated from Problemy Gematol. i Perelivaniya Krovi, No. 2, 13-17(1957). 9p. $1.80(ph), $1.80(mf) JCL or LC.

The effects of radiation on the physiology of bone marrow and on blood production were studied. Conclusions are presented concerning the regeneration of bone marrow elements and the connection of blood, particularly erythrocyte production, on survival of animals exposed to various doses of radiation. (C.H.)

**10796** AEC-tr-3614
A "SECOND BLOW" IN RADIATION SICKNESS. V. N. Vorob'ev (Vorob'yev). Translated from Vestnik Rentgenol. i Radiol. 32. No. 3, 3-5(1957). 6p. $1.80 (ph), $1.80(mf) JCL or LC.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 7457.

**10797** AEC-tr-3615
PATHOPHYSIOLOGICAL REACTIONS IN ACUTE RADIATION SICKNESS. I. R. Petrov and V. K. Kulagin. Translated from Med. Radiol. 2, No. 2, 3-12(1957). 26p. $4.80(ph), $2.70(mf) JCL or LC.

The pathology of radiation sickness is discussed. The reaction of the complete organism to radiation is viewed as a chain of mutually connected and mutually influencing processes. General reactions are explained by the reactions of the nervous system and the humoral factors. The presence of toxemia in radiation sickness is debatable. When present, it is believed to be the result of the appearance in the blood of substances caused directly by radiation. A large number of products of the disturbed metabolism appear in the blood, and the nature of these products is different at different phases of the disease. Transfusion of blood from radiation-exposed animals to control animals has made it possible to isolate the hypotensor effect and the leukopenic effect. The hypotensor effect is shown chiefly by the blood flowing away from the head, and the leukopenic effect by the blood flowing away from the spleen. A large role in radiation sickness is played by the breakdown of nervous activity. The organism's reactivity after radiation exposure remains changed for a long time, and a number of manifestations of radiation damage develop only after long periods of time. The resistance to visceral trauma was found to be reduced after clinical recuperation from radiation sickness. The conflict of nutritive and defensive reflexes in dogs caused a reappearance of certain symptoms of radiation sickness 8 to 10 months after the disease. The study of radiation sickness is necessary primarily for the development of an effective therapy, which must be directed toward eliminating the principal disorders in radiation sickness. 30 references. (C.H.)

**10798** AEC-tr-3622
THE EFFECT OF RADIOACTIVE COBALT ON THE RESISTANCE OF THE BODY TO IONIZING RADIATION. L. A. Dimitrov. Translated from Med. Radiol. 2, No. 4, 11-17(1957). 12p. $3.30(ph), $2.40(mf) JCL or LC.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 43.

**10799** AEC-tr-3623
THE CONDITION OF THE ADRENAL CORTEX IN RADIATION SICKNESS. L. V. Boshenko. Translated from Med. Radiol. 2, No. 4, 44-50(1957). 15p. $3.30(ph), $2.40(mf) JCL or LC.

Changes in weight and ascorbic acid content of adrenal glands were observed during the course of radiation sickness in rats. Doses of 300, 600, and 1500 r resulted in an active drop of ascorbic acid in the first few hours after irradiation. This condition was independent of the severity of radiation sickness. Later changes in the condition of the adrenal cortex depend on the severity of the pathologic process. (C.H.)

**10800** AEC-tr-3624
ON THE PROCESS OF HEALING OF TISSUES INJURED BY X-RAYS. I. V. Shiffer. Translated from Med. Radiol. 2, No. 4, 38-43(1957). 9p. $1.80(ph), $1.80(mf) JCL or LC.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 48.

**10801** AEC-tr-3625

DOSIMETRY OF WOUNDS AND BURNS CONTAMINATED BY RADIOACTIVE SUBSTANCES. A. I. Sautin. Translated from Voenno-Med. Zhur. No. 4, 19-21(1957). 6p. \$1.80(ph), \$1.80(mf) JCL or LC.

A procedure is described for using a beta-gamma radiometer for determinations of the degree of radioactive contamination of wounds and burns. (C.H.)

**10802** AEC-tr-3636

POLYSACCHARIDE FORMATION IN MEGAKARYOCYTES. Fritz Heckner. Translated for Oak Ridge National Lab. from Acta Haematol. 17, 16-24(1957). 12p. \$3.30(ph), \$2.40(mf) JCL or LC.

Cytochemical studies with a polysaccharide stain were made on megakaryocytes of normal and abnormal marrow. Quantitative and qualitative changes in the glycogen content are in direct relationship to the thrombopoietic activity of megakaryocytes. The distinction between maturation stages and cell function is even more definite than with other methods. Loss of glycogen in megakaryocytes exceeding physiological levels is regularly observed in thrombocytopenic states. The most advanced changes are seen in idiopathic thrombocytopenic purpura. Megakaryocytes in acute leukemia show early signs of a remarkable loss of glycogen. (auth)

**10803**

THE EFFECTIVE HALF-LIVES OF Cs AND I IN THE BODY. K. G. McNeill and R. M. Green (Univ. of Toronto). Can. J. Phys. 37. 528-9(1959) Apr.

A cesium accident at Toronto was used to measure the effective half life of Cs$^{137}$, using the whole body counter. The detector was a 5-in. NaI crystal, feeding into a 100-channel pulse height analyzer. Shielding was provided by a steel room. The body content of cesium was measured in three subjects over a period of 140 days. The results are shown graphically. The half lives in three cases were found to be 119 days. 110 days. and 115 days. This is in agreement with Argonne results, but disagrees with the figure given in the NBS handbook. A test was also run on three subjects who for the purpose of an experiment on thyrotoxicosis injected I$^{131}$. The activity was measured as a function of time. For the 0.36-Mev line $\tau/E$ was found to be 8.0, 7.8. and 8.1 days. (A.C.)

**10804**

RADIATION PRESERVATION OF MILK AND MILK PRODUCTS. VIII. RADIATION-DISTILLATION APPARATUS FOR USING HIGH ENERGY ELECTRONS. J. H. Wertheim, J. E. Hoff, G. D. Saravacos, B. E. Proctor, and S. A. Goldblith (Massachusetts Inst. of Tech., Cambridge). Food Technol. 13, 94-6(1959) Feb.

The feasibility of irradiating milk with high-energy electrons under conditions which permit the control of off-flavors has been shown. The apparatus described was designed to produce results similar to those previously obtained with gamma rays. It was not designed, however, to represent the final solution to the problem of milk sterilization. The arrangement of collecting a dose of approximately two million rad by repeated passage through the field was necessitated by the relatively low power output available with the 800 kvp accelerator and should not be taken as a final solution. It was found that the increase in radiation energy from 5000 rad/min to 100,000 rad/min did not require proportional increases in evaporation rates and it is believed that the increase from 0.8 to 2.2 ml/ml/h might be further diminished by a more thorough knowledge of processing conditions. Experiments carried out with raw milk showed that, as expected, no sterilization was achieved when a total of $1.86 \times 10^6$ rad was absorbed. Presterilization of the apparatus with steam would not change this situation. It is hoped, at a later time, that the apparatus can be reconstructed on similar principles to permit irradiation that might lead to sterile milk. (auth)

**10805**

ON THE PRIMARY MECHANISM OF THE BIOLOGICAL EFFECT OF RADIATION. J. L. Shekhtman (Inst. of Biological Physics, Academy of Sciences of the USSR, Moscow). Izvest. Akad. Nauk S.S.S.R., Ser. Biol. No. 2, 172-84(1959) Mar.-Apr. (In Russian)

The derangement of the mitotic capacity of the cell as caused by radiation is primarily associated with the cell nucleus rather than with cytoplasm. In contrast to cytoplasmic structures, the nucleoprotein structures of the nucleus are unique, and local injury of even a single structure calls forth profound disturbances of the rhythm and sequence of the multiplication processes of nucleic acids and of protein synthesis. The capacity of the cell to normal division is thereby lost and the cell dies, eventually after several atypical divisions. In the embryonic material irradiated at early stages of development distinct maxima and minima of radiosensitivity are noted corresponding to certain phases of karyokinesis. Analysis of radiosensitivity of two cultures of B. coli the normal and glucose one, irradiated with x rays and alpha rays of polonium has revealed certain regularities which suggest the presence in the glucose culture of a polyploid structure of nuclear substance. These findings comply with similar results obtained by Ogg and Zelle in the camphor and normal culture of B. coli. Thus it appears that most promising for the protection and therapy of the radiation disease are those methods which are based on the stimulation of the reparative processes within the irradiated organism, such as the use of emulsions of bone marrow tissue, transfusion of blood and of its substitutes, and transplantation of organs. (auth)

**10806**

RADIOPROTECTIVE EFFECT OF TESTOSTERONE AND SOME OTHER STEROID HORMONES. R. Ghys (Univ. of Liege). J. belge radiol. 41, 736-55(1958). (In French)

Two Mev x rays produced by a Van de Graaff generator have in rats a RBE which is not different from that of classical x rays. In female rats, injection of cortisone or DOCA does not produce an appreciable radioprotection; on the contrary, estradiol and testosterone are protective. By irradiation of the animal with neutrons or by radio-phosphorus injection, it is possible to study, in a relatively selective way the intestinal and medullary components of radiation sickness. The preliminary injection of a high dose of testosterone protects females against both types of irradiation, but increases the sensibility of males. This effect lasts for at least two weeks. The mechanism of this protection is still under investigation. (auth)

**10807**

EFFECT OF GAMMA-RADIATION ON WEEDS. H. J. M. Bowen and S. R. Smith (Wantage Radiation Lab., Grove, Berks, Eng.). Nature 183, 907(1959) Mar. 28.

An investigation was made of the doses of $\gamma$ radiation needed to prevent weed seeds from growing. The seeds were stored at 32 per cent relative humidity and irradiated in air with a range of doses from 0 to 100,000 rads of $\gamma$ radiation from cobalt-60. They were then planted in steam-sterilized soil, and the number of plants arriving at maturity were counted. The results obtained indicate that germination was not related to survival, as irradiated seedlings were generally weaker than controls, and often had distorted first leaves. Seedlings which survived matured later than controls but were not obviously distinguishable otherwise; induced sterility was frequently noted. The investigation also indicated that arable soils need treatment with at least 100,000 rads of $\gamma$ radiation to inhibit weed growth effectively. (J.H.M.)

**10808**

INDUCTION OF MOUSE LEUKAEMIA WITH PURIFIED NUCLEIC ACID PREPARATIONS. Esther F. Hays, Norman S. Simmons, and William S. Beck (Univ. of California, Los Angeles). Nature 180, 1419-20(1957) Dec. 21.

The incidence of leukemia was increased in mice of three strains by the injection into newborn mice of cell-free extracts of nucleic acid preparations from a high-leukemia donor strain. These preliminary results in hybrid animals suggest that free nucleic acid is leukemogenic, although the possibility is not ruled out that a virus or provirus is, in fact, the active agent in cell-free extracts, and that the preparations contained active virus nucleic acid. It is unlikely, however, that intact active virus could survive the nucleic acid isolation procedure. (C.H.)

**10809**

LATENT RADIATION DAMAGE AND SYNCHRONOUS CELL DIVISION IN THE EPIDERMIS OF AN INSECT. I. NONREVERSIBLE EFFECTS LEADING TO LOCAL RADIATION BURNS. W. F. Baldwin and T. N. Salthouse (Atomic Energy of Canada Ltd., Chalk River, Ont.). Radiation Research 10, 387-96(1959) Apr.

In the bloodsucking insect Rhodnius prolixus, cell division preparatory to molting takes place in the nymphal epidermis only during a fixed period after a meal of blood. Since feeding determines the time of mitosis in the epidermis, this insect serves as a good subject for studies of latent radiation damage. Results are presented from a study in which latent radiation damage in the epidermal layer was converted into visible burns after a blood meal. Photographs of histological studies and a timetable of events during development of latent radiation damage are included. (C.H.)

**10810**

LATENT RADIATION DAMAGE AND SYNCHRONOUS CELL DIVISION IN THE EPIDERMIS OF AN INSECT. II. REVERSIBLE EFFECTS IN BURN REPAIR. W. F. Baldwin and T. N. Salthouse (Atomic Energy of Canada Ltd., Chalk River, Ont.). Radiation Research 10, 397-9(1959) Apr.

The time required for healing and molting in irradiated nymphs of the bloodsucking insect Rhodnius prolixus can be reduced almost to normal if they are given a period in which to recover from some of the effects of irradiation before being fed. (C.H.)

**10811**

A CHRONIC IRRADIATION SOURCE FOR SMALL ANIMALS. Howard E. Noyes (Walter Reed Army Medical Center, Washington, D. C.). Radiation Research 10, 400-1(1959) Apr.

A radiation exposure chamber is described for the chronic irradiation of small animals. (C.H.)

**10812**

THE HIERARCHY OF MODES OF RADIATION DEATH IN SPECIFICALLY PROTECTED MICE. Henry Quastler and Marion Zucker (Brookhaven National Lab., Upton, N. Y.). Radiation Research 10, 402-9(1959) Apr.

Specific protection prevents one particular mode of radiation death without strongly affecting other syndromes; in the case of marrow, intestinal, and oral death, this can be accomplished by partial shielding. This method allows the study of situations which cannot be realized with total-body irradiation with or without unspecific protection. The protective effect of partial shielding on the marrow syndrome is not affected by doses up to several kilorads; this can be seen if intestinal death is prevented. Denudation of the duodenum is compatible with survival; regeneration occurs even after doses of several kilorads. Mice irradiated with several kilorads, even though protected against marrow, intestinal, and oral death, succumb to an unidentified disturbance. (auth)

**10813**

THE EFFECT OF PITRESSIN ON POSTIRRADIATION POLYDIPSIA AND POLYURIA IN THE RAT. Clyde M. Williams and George M. Krise (Univ. of Texas and U. S. Air Force, Balcones Research Center, Austin, Texas). Radiation Research 10, 410-17(1959) Apr.

The intramuscular injection of 500 mU of Pitressin tannate in peanut oil, either immediately before or immediately after whole-body irradiation by 1500 r of Co$^{60}$ $\gamma$ rays, was found to inhibit polydipsia and polyuria in the adult rat. Aqueous solutions of Pitressin, when injected intramuscularly either before or after irradiation, did not inhibit the postirradiation polydipsia and polyuria evoked by 1500 r of whole-body irradiation. Rats deprived of water for the first 24 hours after 500 r of whole-body irradiation did not excrete urine in amounts significantly greater than were excreted by nonirradiated controls. Water intakes and urine outputs during the first 24 hours after 1500 r of whole-body irradiation decreased linearly with increasing dose of injected Pitressin tannate in peanut oil; 150 mU was found to be the minimum dose of Pitressin which produced a water intake and urine output not significantly different from those of the nonirradiated controls during the first 24 hours postirradiation. The irradiation of Pitressin tannate in peanut oil (in a concentration of 1500 mU/ml) by doses up to 20,000 r did not alter the ability of Pitressin to inhibit the polydipsia and polyuria evoked by 1500 r of whole-body irradiation. (auth)

**10814**

THE RELATIVE BIOLOGICAL EFFECTIVENESS OF 200-Kvp X-RAYS, COBALT-60 GAMMA-RAYS, AND 22-Mevp X-RAYS, DETERMINED FROM THE DOSE-SURVIVAL CURVE OF SACCHAROMYCES CEREVISIAE. W. K. Sinclair, S. E. Gunter, and A. Cole. Radiation Research 10, 418-32(1959) Apr.

The relative biological effectiveness of cobalt-60 $\gamma$ rays (1.17, 1.33 Mev) and 22-Mevp x rays from a betatron with reference of 200-kvp x rays (primary HVL 1.4 mm Cu) has been determined by using the slope of the survival curve of the yeast Saccharomyces cerevisiae (based on macrocolony counts) as the biological end point. The average RBE of five experiments was found to be 0.85 for cobalt-60 $\gamma$ radiation and 0.85 for 22-Mevp x radiation, with uncertainties of the order of ±0.05 in each case. No significant difference between cobalt-60 $\gamma$ radiation and 22-Mevp x radiation was demonstrated. (auth)

**10815**

THE EFFECTS OF ACCELERATED CARBON NUCLEI AND OTHER RADIATIONS ON THE SURVIVAL OF HAPLOID YEAST. I. DOSIMETRY OF THE CYCLOTRON BEAMS. Ann C. Birge and Joseph A. Sayeg (Univ. of California, Berkeley). Radiation Research 10, 433-48(1959) Apr.

The experimental apparatus used for the irradiation of yeast cells with cyclotron beams of 20-Mev deuterons, 40-Mev $\alpha$ particles, and 120-Mev carbon nuclei is described. The physical measurements necessary for an accurate determination of dose and average LET are also described. The dose calculation from ionization-chamber measurements is given, along with the estimated uncertainties that produce an over-all error ranging between 5 and 10%. (auth)

**10816**

THE EFFECTS OF ACCELERATED CARBON NUCLEI AND OTHER RADIATIONS ON THE SURVIVAL OF HAPLOID YEAST. II. BIOLOGICAL EXPERIMENTS. Joseph A. Sayeg, Ann C. Birge, Carl A. Beam, and Cornelius A. Tobias (Univ. of California, Berkeley). Radiation Research 10, 449-61(1959) Apr.

The radiation sensitivity for the inhibition of colony formation in the haploid yeast, Saccharomyces cerevisiae, has been measured with a series of radiations that cover a range in LET from 20 to 5000 Mev $cm^2/gm$. In addition to x rays and $Po^{210}$ $\alpha$ particles, the radiations employed include cyclotron deuterons, $\alpha$ particles, and carbon nuclei with a charge of 6. The radiation sensitivity increases with increasing LET until it reaches a maximum corresponding to an RBE of 2 for 3.4-Mev $\alpha$ particles. At still higher LET values, the radiosensitivity decreases progressively and corresponds to an approximately constant inactivation cross section of 1 $\mu^2$. Implications of the experimental results are considered in terms of target theory, the migration model, and the track-segment calculation. (auth)

**10817**

EFFECT OF X-RADIATION ON DNA METABOLISM IN VARIOUS TISSUES OF THE RAT. I. INCORPORATION OF $C^{14}$-THYMIDINE INTO DNA DURING THE FIRST 24 HOURS POSTIRRADIATION. Oddvar F. Nygaard and Richard L. Potter (Univ. of Michigan, Ann Arbor). Radiation Research 10, 462-76(1959) Apr.

The effect of total-body x irradiation on the DNA synthesis in thymus, spleen, and small intestine of the rat has been studied throughout the first 24 hours after exposure to doses ranging from 50 to 800 r. The amounts of radioactivity, from thymidine-2-$C^{14}$, incorporated into DNA over 1-hour periods were used as a relative measure of synthesis. A rapid and extensive decrease in the incorporation of radioactivity was observed in all three tissues after the highest doses, with a gradually decreasing effect with lowering of the dose. In thymus and spleen there was no indication of recovery within the 24-hour period, whereas in the intestine there was an increase in labeling after 8 hours at all dose levels. The data obtained for the small intestine are compatible with the assumption that the decreased incorporation is, in part, caused by a delayed onset of DNA synthesis in some of the cells. This delay, at least at the earliest times after irradiation, is not the result of inhibition of mitosis. (auth)

**10818**

REDUCTION OF MUTATION BY POSTIRRADIATION TREATMENT AFTER ULTRAVIOLET AND VARIOUS KINDS OF IONIZING RADIATIONS. R. F. Kimball, Nenita Gaither, and Stella M. Wilson (Oak Ridge National Lab., Tenn.). Radiation Research 10, 490-7 (1959) Apr.

Postirradiation exposure to streptomycin reduces the amount of recessive lethal and deleterious mutation produced in Paramecium aurelia by x rays in the absence of oxygen as well as in its presence, by $\alpha$ particles, and by ultraviolet light. Thus the reversible step that is influenced by the posttreatment is common to the mutational processes initiated by all these radiations, making it probable that this step is more closely related to the structure and activities of the chromosomes than to the nature of the initial physical events in them. Certain peculiarities of the ultraviolet dose curves lead to the suggestion that this radiation acts not only as a mutagen but also as a recovery agent through its effects on growth and division. (auth)

**10819**

SOME PROBLEMS OF LABOR HYGIENE IN THE WORK WITH BETATRONS IN THE DETECTION OF DEFECTS. L. V. Kuznetsova. Trudy Vsesoyuz. Konf. po Med. Radiol. Voprosy Gigieni i Dozimetrii 19-21(1957). (Translation from Referat. Zhur. Met. No. 8, 1958, p. 286.)

To decrease the effect of radiation in work with the betatron it is imperative to provide for correct planning of the working space and the auxiliary compartments for the photographic laboratory and for storing specimens which are to be tested for defects; to furnish the control panel with special shields; to prohibit the presence of personnel in the laboratory when the betatron is switched on; to protect the laboratory by special shielding which would decrease the radiation in adjacent compartments to 0.1 of the permissible limit dose; to conduct the observation of the work with the aid of mirrors and periscopes; and to equip the door in the laboratory with a special interlock.

**10820**

SOME PROBLEMS OF LABOR HYGIENE IN THE WORK WITH RADIOACTIVE ISOTOPES IN METALLURGY AND MACHINE BUILDING. G. M. Parkhomenko. Trudy Vsesoyuz. Konf. po Med. Radiol. Voprosy Gigieni i Dozimetrii 22-6(1957). (Translated from Referat. Zhur. Met. No. 8, 1958, p. 286.)

The regions of application of radioactive isotopes in machine building and prophylactic measures are examined.

**10821**

THE EFFECT OF INDICATOR DOSES OF CERTAIN RADIOACTIVE ISOTOPES ON THE LUMINESCENCE OF BLOOD AND BONE MARROW. O. S. Sergel, G. A. Zubovskii, and L. A. Ivanitskaya (State Scientific Research Inst. of Roentgenology and Radiology). Vestnik Rentgenol. i Radiol. 34, 59-61(1959) Jan.-Feb. (In Russian)

Studies were made of the effect of administration of a single indicator dose of $I^{131}$ on the blood in clinical conditions and Na$^{24}$ on the blood and bone marrow in experimental conditions. I$^{131}$ was administered in the dose of 2 to 20 mc for diagnosis in various diseases of the thyroid gland. The effect of Na$^{24}$ on rats and rabbits was studied by intravenous injection of the preparation in the dose of 1 to 2 mc per kg of body weight. The cytochemical luminescent microscopical analysis of native preparations reveal changes in the color and brightness of luminescence of the cellular elements of blood plasma and bone marrow. These changes appeared in a number of cases in 15 to 20 minutes and remained during 1 to 3 days after administration of the preparation. The character of changes was different depending on the initial condition. (auth)

# CHEMISTRY

## General

**10822** AECU-4070
Kansas. Univ., Lawrence.
OBSERVATIONS OF THE METHOD OF HESS FOR DETERMINING PRECISION LATTICE PARAMETERS. Harry A. Eick and Paul W. Gilles. Jan. 1959. 6p. [Project No. 5]. Contract [AT(11-1)-83]. $1.80(ph), $1.80(mf) OTS.

The method of Hess for determining lattice parameters and their standard errors from x-ray powder diffraction films was investigated. The equations are applicable to various cameras and crystal systems. The results of a series of computations in which the initial approximations were deliberately varied over wide ranges are presented. The experimental results showed that for the computation of precise lattice parameters, the initial estimates need not be good. A parameter input value of zero should be avoided, but otherwise almost any value will do. (J.R.D.)

**10823** AECU-4076
Utah. Univ., Salt Lake City. Inst. for the Study of Rate Processes.
QUANTITATIVE DETERMINATION OF ADSORBED SULFATES ON THORIA BY MEANS OF INFRARED SPECTROSCOPY. Technical Report No. III. Lowell G. Tensmeyer and Milton E. Wadsworth. Jan. 1959. 17p. For [Oak Ridge National Lab.]. Contract W-7405-eng-26, Subcontract 1075. $3.30(ph), $2.40(mf) OTS.

By utilizing the KBr-disk technique, it is possible to apply infrared analysis quantitatively to the determination of species adsorbed from aqueous solutions on solids of large specific area. Adsorption of sulfates on thoria from aqueous sulfate solutions gave a characteristic infrared spectrum with absorbance bands occurring at 8.4, 8.9, and 9.6 $\mu$. Absorbance measurements at these wave lengths were precise to 1 to 2% and were directly proportional to the amount of adsorbed sulfate in the disk, after compensation for thoria and sulfate crystallized in the drying process. The method outlined here determines 0.5 micromole quantities of sulfate, and was used on thoria samples having areas greater than 10 meters$^2$ g$^{-1}$. (auth)

**10824** AECU-4082
General Electric Co. Materials and Processes Lab., Schenectady, N. Y.
STRAIN CYCLING TESTS ON LARGE SPECIMENS OF AISI TYPE 347 STAINLESS STEEL AND 2-$^1/_4$ CROLOY. A. K. Schnieder and J. J. LaCagnina, Jr. Feb. 9, 1959. 20p. (DF-58-SL-211). $3.30(ph), $2.40(mf) OTS.

Twenty-one specimens one in. in diameter were tension-compression strain cycled to failure. Six specimens had transverse holes. Load-strain and load-time records were made. The unit strain ranges used were 0.026 and 0.009. The stainless steel specimens were tested at 662°F (350°C), the 2-$^1/_4$ Croloy specimens at 850°F. The cyclic life of a specimen with a hole can be predicted from smooth specimen tests by using the elastic stress concentration factor increased by 15%. In the commonly used exponential relationship between cycles to failure (N) and strain range ($\Delta\epsilon_p$) $N^K \Delta\epsilon_p = c$. The material constants are: for AISI type 347 stainless steel $K = 0.50$, $c = 0.42$; for 2-$^1/_4$ Croloy $K = 0.81$, $c = 2.44$. Comparing these tests with those made by others indicates that AISI type 347 stainless steel exhibits a pronounced size effect. The cyclic life at the same plastic strain range is reduced to about one half as the specimen diameter is increased from 0.1875 to 1.0 in. The size effect is negligible for 2-$^1/_4$ Croloy. (auth)

**10825** AECU-4086
Syracuse Univ., N. Y. Research Inst.
THE FORMATION OF DETONATION IN SATURATED MIXTURES OF KNALLGAS–STEAM AND IN STOICHIOMETRIC MIXTURES OF DEUTERIUM–OXYGEN (HEAVY KNALLGAS) SATURATED WITH DEUTERIUM OXIDE (HEAVY WATER). Final Report. James A. Luker, Leonard B. Adler, and Edward C. Hobaica. Jan. 23, 1959. 363p. For [Oak Ridge National Lab.]. Contract W-7405-eng-26, Subcontract 548. (SURI-Ch.E-273-591F). $57.60(ph), $11.10(mf) OTS.

The purpose of this investigation was to determine the reaction characteristics of saturated mixtures of knall gas (stoichiometric mixture of hydrogen and oxygen)–steam and mixtures of heavy knall gas (stoichiometric mixture of deuterium and oxygen) saturated with heavy water. These mixtures were studied experimentally over composition ranges from no reaction limit to enriched compositions which supported detonations. (auth)

**10826** AECU-4087
Kansas. Univ., Lawrence.
PRECISE LATTICE PARAMETERS OF SELECTED RARE EARTH TETRA- AND HEXA-BORIDES. Harry A. Eick and Paul W. Gilles. [1958]. 12p. [Project No. 1]. Contract [AT(11-1)-83]. $3.30(ph), $2.40(mf) OTS.

Refractory tetraborides and hexaborides of seven of the rare earth elements were prepared by heating intimate mixtures of the sesquioxide and boron in a high vacuum in tantalum, molybdenum, or graphite crucibles. Preparatory procedures were varied until single phase samples were obtained. The samples were analyzed by chemical and x-ray diffraction procedures. Precise lattice parameters of the samples were obtained by analytical extrapolation using a digital computer. Some new phases of unknown composition and structure were observed. The results indicate a pronounced difference between the tetraborides and the hexaborides in the trends of their lattice parameters. The tetraborides show a nearly linear decrease in lattice parameters through the series, but the hexaborides show an irregular decrease. (auth)

**10827** AERE-C/M-230
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
THE ION EXCHANGE AND ION ADSORPTION PROPERTIES OF THORIA. D. J. O'Connor. Feb. 1, 1955. 22p. (RCTC-P/35).

The ion exchange, ion adsorption, and electrical surface properties of sintered thoria in water, in solutions of acids, alkalis, several potassium salts, hydrogen peroxide, uranyl sulfate, and trisodium polyphosphate were investigated using the streaming current method of electrokinetics. Thoria, sintered at 1700°C, was positively charged in contact with water. The results are best interpreted by assuming that the electrical double layer at the thoria-solution interface arises principally from basic ionization of surface hydroxyl groups, and that in addition to the usual phenomenon of iron adsorption, the surface charge can be considerably influenced by anion exchange involving hydroxyl groups. In suitable circumstances, (e.g., in the presence of added hydroxyl ion), cation exchange of $H^+$ ions can be stimulated. In most cases, the notable exception being with trisodium polyphosphate, the adsorption of ionic species at the $ThO_2$-solution interface was completely reversible. The variation of the $\zeta$ potential in trisodium polyphosphate solutions indicated that the polyphosphate ion was reacting chemically at the surface (anion exchange). In addition to providing information on the origin of the electrical surface charge at $ThO_2$-solution interfaces, the streaming current method also provides information on chemical reactions occurring at $ThO_2$ surfaces. In the present instance, this information may assist in discussing such problems as the stability and deflocculating action of phosphates and other inorganic stabilizing agents on thoria suspensions. (auth)

**10828** AERE-C/M-268
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
URANIUM DIOXIDE AS A FUEL ELEMENT. L. E. J. Roberts. Jan. 23, 1956. 8p.

The chemistry of uranium dioxide is reviewed with particular reference to its use as a fuel element in a water-cooled reactor. The likely distribution of fission product atoms in the uranium dioxide lattice is discussed and diffusion coefficients for rare gas diffusion are calculated. It is emphasised that uranium dioxide oxidizes easily and that the precise oxidation state is important in that it affects all transport and surface phenomena. (auth)

**10829** AERE-C/M-269
United Kingdom Atomic Energy Authority. Research Group. Chemistry Div., Woolwich Outstation, England.
THE LITHIUM CONTENT OF TWO ROCKS G-1 AND W-1. R. V. Jury. Jan. 1956. 5p.

The lithium content of two rock samples intended for use as standards in silicate rock analysis was determined by three different spectrographic methods, viz. a modified barium chloride flux method, a sodium fluoride flux method, and a carrier-distillation method in thoria base. A value of 15 ppm was obtained in standard W-1 for which the value recommended by Ahrens is 9 ppm. The recommended value of 22 ppm for G-1 was confirmed. (auth)

**10830** AERE-C/R-1088
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
THE SOLUBILITY OF PU(IV) OXALATE IN NITRIC ACID/OXALIC ACID MIXTURES. C. J. Mandleberg and K. E. Francis. Jan. 2, 1953. 5p.

The solubility of Pu(IV) oxalate was determined in nitric acid-oxalic acid systems. A region of minimum solubility was found to be 1.5 $\underline{M}$ $HNO_3$/0.025 $\underline{M}$ $(COOH)_2$. (auth)

**10831** AERE-C/R-1232/2
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
THE DETERMINATION OF NIOBIUM IN SOME AFRICAN LOW GRADE MINERALS AND MINERAL DRESSING PRODUCTS. PART II. SPECTROGRAPHIC. R. P. Thorne and B. M. Childs. Sept. 19, 1953. 8p.

A spectrochemical method was developed for the determination of Nb in low-grade Sukulu ores with an accuracy of ±10% for the range 0.05 to 0.5% $Nb_2O_5$. The ore is buffered with a titanium oxide/ammonium sulfate flux, and pellets from the mixture are sparked between Cu electrodes at 10 amps d-c. The percentage of Nb is determined from a standard calibration curve obtained from synthetic standards. (auth)

**10832** AERE-C/R-2029
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
THERMODYNAMICS OF THE SYSTEMS $HNO_3-H_2O$-ETHERS. E. Glueckauf and B. Davies. Aug. 1956. 27p.

In the ternary system $HNO_3-H_2O$-Ether a great number of interactions between the components can be detected from an analysis of the activity and heat-of-mixing data. Solubility of $H_2O$ in ethers alone at low concentrations of water is an endothermic process, but for ethers which can take up much water there is a cooperative effect between the dissolved water molecules, which renders the solution of water exothermic at higher water concentrations. Solution of $HNO_3$ in pure ether is strongly exothermic (~7,200 cal/mol) (apparently independently of the type of ether) and a 1:1 complex is formed by hydrogen bonding, which shows practically no dissociation except for ethers of high water solubility. The water uptake by water-free $HNO_3$-ether mixtures is an exothermic process, the heat release varying greatly with the affinity of the ether for water, from a few hundred cal/mol $H_2O$ for $Bu_2O$ to 4,000 for dibutylcarbitol. In equilibrium with aqueous solutions of nitric acid, the $HNO_3$ uptake by the ether is at first proportional to the $HNO_3$ activity, and there is an additional water uptake by the ether, at first proportional to the $HNO_3$ uptake. This varies from 0.5 $H_2O$ per $HNO_3$ for $\underline{n}$-di-hexyl ether to 8 $H_2O$ per $HNO_3$ for penta ether. The affinity of the ether for $HNO_3$ rises in the same order as the uptake of excess water, and the above-mentioned heat effects suggest that it is the ternary Ether-$HNO_3$-$H_2O$ interaction rather than the binary Ether-$HNO_3$ interaction which determines the extraction affinity of the ether for $HNO_3$. All the ether solutions of nitric acid show, from their activity curves, that the dissolved nitric acid-ether complex is subject to a solute-solute attraction in the ether phase. In the case of poly-ethers, which contain more than 1 oxygen atom per molecule, when the molal ratio $HNO_3$: Ether = 1:1 is approached, the other ether oxygens also take part in binding $HNO_3$, but with less heat release than the first oxygen atom. In the case of mono-ethers, more than one molecule of nitric acid per molecule of ether can be extracted into the ether, provided the ether is sufficiently stable. In the case of $Bu_2O$ the partial molar heat content of this excess $HNO_3$ is −3,450 cal/mol $HNO_3$ as compared with −7,500 for the first $HNO_3$ molecule. Detailed data are given for di-n-butyl ether and for di-butyl-carbitol, representing a mono- and a polyether, respectively. (auth)

**10833** AERE-C/R-2155

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE HYDROLYTIC BEHAVIOUR OF PLUTONIUM IONS IN SULPHURIC ACID. D. W. Grant and D. E. Glanville. May 1957. 18p. (HARD(B)/P/31; RCTC-P-94).

A thermal reduction of Pu(VI) sulfate by water at elevated temperatures is reported. The solubility of Pu(III) sulfate and the hydrolysis of Pu(IV) sulfate at elevated temperatures are investigated. The results are considered with particular reference to the possible use of plutonium sulfate solutions in a homogeneous aqueous reactor. (auth)

**10834** AERE-C/R-2758

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

PROTON ACTIVATION ANALYSIS IN THE DETERMINATION OF SUBMICROGRAM AMOUNTS OF BORON IN SILICON. R. A. Gill. Dec. 1958. 48p.

Proton activation is discussed as a possible method for the determination of light elements in trace amounts. A method is described for determining boron in silicon down to $10^{-9}$g using proton activation analysis. The sample is irradiated in the Harwell Synchrocyclotron with protons of 20-Mev maximum energy. The principle reactions are $B^{11}(p,n) \rightarrow C^{11}$ ($t_{1/2}$ = 20.4 minutes, $\beta^+$ emission) and $Si^{30}(p,n) \rightarrow P^{30}$ ($t_{1/2}$ = 2.5 minutes, $\beta^+$ emission). The $C^{11}$ is chemically separated from the silicon in the presence of carrier and the ratio of the $(C^{11}/P^{30})$ activity determined. A series of specially prepared boron-doped silicon samples was used to check the method. (auth)

**10835** AERE-C/R-2802

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

A THEORETICAL INTERPRETATION OF THE ALPHA PARTICLE INDUCED COMBINATION OF NITROGEN AND OXYGEN. F. Moseley. Jan. 1959. 38p. $0.70 (BIS).

A theory is presented to account for the experimental data available at the present time on the fixation of nitrogen in nitrogen−oxygen mixtures subjected to $\alpha$ particle irradiation. Evidence is presented to show that the agreement between the proposed over-all mechanism and previous experimental results is good. By making use of the theory, the values of $G_{NO_2}$ and $G_{O_3}$ for air were evaluated and the variations in these G values determined at other oxygen−nitrogen pressure ratios than that for air. (auth)

**10836** AERE-M/R-1333

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

SUPERLATTICE FORMATION IN URANIUM−MOLYBDENUM ALLOYS. P. C. L. Pfeil and J. D. Browne. Jan. 19, 1954. 15p.

The investigation of the constitution of uranium−molybdenum alloys has been extended to lower temperatures. The body-centered cubic solid solution, $\gamma$, becomes unstable relative to a body-centered tetragonal phase, $\gamma_1$, in the composition range near $U_3Mo$. Only a small volume contraction occurs, though the electrical resistivity decreases sharply. Evidence of superlattice reflections has been obtained and a possible structure for the phase deduced. The existence of a stable $(\gamma + \gamma^1)$ field has been discovered, and the $(\alpha + \gamma)/\gamma$ and $(\alpha + \gamma^1)/\gamma_1$ phase boundaries established. The results are discussed in terms of alloy theory as applied to uranium. (auth)

**10837** BMI-1329

Battelle Memorial Inst., Columbus, Ohio.

SOLUBILITY OF LITHIUM HYDROXIDE IN WATER AND VAPOR PRESSURE OF SOLUTIONS OF LITHIUM HYDROXIDE ABOVE 220 F. Elmer F. Stephen and Paul D. Miller. Mar. 19, 1959. 21p. Contracts NObs-56405 and W-7405-eng-92. Subcontract No. N-156. $0.75 (OTS).

The solubility of lithium hydroxide in water was determined at 220 to 650°F. The literature furnished data for temperatures below 200°F. A maximum in the curve was found at about 240 and a minimum at 480°F. The variations in solubility, however, were relatively small. At 40, the solubility is 12.7 g LiOH per 100 g $H_2O$, while at 240, it is 17.7, and at 650°F, it is 16.5. The vapor pressures of 4.76 wt. % (2.09 molal), 8.59 wt. % (3.92 molal), and saturated (approximately 6.25 molal) lithium hydroxide solutions were measured as a function of temperature. At about 688°F, the more dilute solution showed a depression in vapor pressure of about 130 psi, the intermediate 154 psi, and the saturated 158 psi. The more dilute solution showed a greater deviation from Raoult's law than did the other two. Vapor-pressure data for sodium hydroxide solutions were compared with those for lithium hydroxide of similar concentration by weight and molality. (auth)

**10838** BNL-510

Brookhaven National Lab., Upton, N. Y.

STUDY OF CORROSION ON VARIOUS METALS IN THE CALCINING OF AQUEOUS RADIOACTIVE WASTES CONTAINING ZIRCONIUM FLUORIDE AND ALUMINUM NITRATE AS BULK SALTS. E. J. Tuthill and R. F. Domish. May 1958. 48p. $1.50(OTS).

The calcination of bulk salts of Zr and Al in high level radioactive wastes to their stable oxides is a logical step toward ultimate disposal. The outstanding objectives here are to achieve maximum chemical stability and minimum volume. Since Zr wastes contain the bulk salts zirconium fluoride, aluminum fluoride, and aluminum nitrate, the calcination which requires temperatures up to 700°C obviously presents a serious problem with respect to corrosion of the container materials. The present study was undertaken for the purpose of measuring the resistance of certain selected materials to the corrosive conditions encountered in the calcination of simulated Zr waste solutions in rotary ball kilns. Two separate investigations were made: the first centered on the use of two kilns in series, and the second involved a single kiln. The purpose of using two kilns in the first investigation was to separate the oxides of nitrogen from the hydrogen fluoride in the off-gases. Denitration was accomplished largely in the first kiln at temperatures below 400 and defluorination in the second kiln at temperatures above 700°C. The second investigation involving a single-kiln unit was made because several alloys had alrady shown favorable resistance to conditions encountered in the high temperature (defluorination) unit of the double-kiln apparatus. Results of the study indicated that no advantage with respect to corrosion was realized by using the double-kiln apparatus, and that with either the single unit or the double unit design at least four alloys are probably suitable as materials of construction for calciner vessels. (auth)

**10839** BNL-2382
Brookhaven National Lab., Upton, N. Y.
ANALYSIS OF $BrF_3$, $BrF_5$ AND $UF_6$ UTILIZING HIGH RESOLUTION NUCLEAR MAGNETIC RESONANCE SPECTRA. James N. Shoolery, Eli L. Goodman, and J. Littman. [1955?]. 4p. $1.80(ph), $1.80(mf) OTS.

It was found feasible to analyze mixtures of $BrF_3$, $BrF_5$, and $UF_6$ in the concentration ranges studied by nuclear magnetic resonance techniques without the necessity of handling materials outside of their Teflon containers. The method outlined in detail was found to be rapid, sensitive, and accurate. (J.E.D.)

**10840** BNL-2717
Brookhaven National Lab., Upton, N. Y.
EQUIVALENT ORBITAL BOND MOMENTS. APPLICATIONS TO CARBON DIOXIDE, WATER, AND DIBORANE. Walter G. Hamilton. [1955]. 29p. $4.80 (ph), $2.70(mf) OTS.

Self-consistent field molecular orbitals for $CO_2$, $H_2O$, and the $B_2H_4$ skeleton of diborane were transformed into equivalent orbital representations, and bond moments were defined as the dipole moments of the corresponding equivalent orbitals. If a maximum localization criterion is imposed, and hybrid moments (atomic dipole terms) on central atoms are omitted, moments of 2.6 D ($C^+O^-$) in $CO_2$, 1.4 D ($O^-H^+$) in water, and 2.03 D ($B_2^+H^-$) in a line perpendicular to the B–B bond in diborane are obtained. The treatment of water does not seem to allow a separation of well-localized bond and lone-pair moments with the proper directional properties. The bond moment of C–H in methane, according to these criteria, is 0.6 D ($C^-H^+$). It is concluded that the method is a valid approach to the problem of non-empirical calculation of bond moments in polyatomic molecules. (auth)

**10841** CF-57-6-81
Oak Ridge National Lab., Tenn.
FUSED SALT COMPOSITIONS. C. J. Barton. June 20, 1957. Decl. Feb. 20, 1959. 11p. Contract W-7405-eng-26. $3.30(ph), $2.40(mf) OTS.

The compositions of the compounds and fused salt mixtures referred to in the ANP project by numbers are given. (T.R.H.)

**10842** CF-58-3-89
Oak Ridge National Lab., Tenn.
EXPERIMENTS ON REMOVAL OF THE $ThO_2$ SLURRY FROM LOOPS. H. O. Weeren and J. N. Snyder. Mar. 20, 1958. 4p. Contract [W-7405-eng-26]. $1.80 (ph), $1.80(mf) OTS.

The $ThO_2$ slurry used in in-pile loops is very difficult to remove from the loops at the end of a run. It is suggested that the slurry can be more easily removed by circulating it continuously through a hydroclone until virtually all of the solids have been discharged into an underflow pot. Several tests were to test the performance of the hydroclone for this application. In all cases better than 99% of the slurry was collected in the underflow pot. (auth)

**10843** CF-58-6-78
Oak Ridge National Lab., Tenn.
FLUIDIZATION CHARACTERISTICS OF PARTICULATE FILTER MEDIA. W. J. Lee. June 12, 1958. 10p. Contract [W-7405-eng-26]. $1.80(ph), $1.80(mf) OTS.

Predictions of water velocities at which fluidization and massive entrainment of filter media (sea sand, Ottawa sand, silica, and alumina) will occur in special filter beds are presented. Pressure gradients in the various fluidized beds and the maximum bed expansions expected are tabulated. (auth)

**10844** CF-58-6-94
Oak Ridge National Lab., Tenn.
ARC CALCINATION OF THORIUM OXIDE. K. O. Johnsson. June 25, 1958. 8p. Contract [W-7405-eng-26]. $1.80(ph), $1.80(mf) OTS.

An over-all description of the background material on the use of electrical arcs for heating of powders is presented as well as a summary of experimental studies on the arc calcination of thoria. Favorable results have been indicated both with heating thoria powder in an arc heated gas and with thoria formed into a consumable electrode. Use of a consumable electrode produces thoria particles 0.1 to 0.01 μ in diameter. It is recommended that additional electrodes be fabricated and further arc calcination tests be run to produce a quantity of product sufficient for evaluation. (auth)

**10845** CF-58-6-119
Oak Ridge National Lab., Tenn.
ON THE KINETICS OF OXIDATION BY NITRIC ACID. J. E. Savolainen. June 26, 1958. 8p. Contract [W-7405-eng-26]. $1.80(ph), $1.80(mf) OTS.

A method of predicting the oxidation rates by $HNO_3$ in aqueous solutions is indicated by the results of experiments on the ferrous nitroso clock reaction. (auth)

**10846** CF-58-8-17
Oak Ridge National Lab., Tenn.
IMPURITIES IN RECLAIMED LEAD CASTINGS. D. M. Shepherd. Aug. 1, 1958. 13p. Contract [W-7405-eng-26]. $3.30(ph), $2.40(mf) OTS.

The nature of impurities found in reclaimed Pb and the effects of their inclusion in castings were investigated. It was concluded that impurities are difficult to remove and may result in unwanted casting characteristics. Recommendations for Pb reclamation are listed. (J.R.D.)

**10847** CF-58-8-53
Oak Ridge National Lab., Tenn.
A COMPARISON OF FIXED AND MOVING BED ION-EXCHANGE. C. W. Hancher. Aug. 20, 1958. 26p. Contract [W-7405-eng-26]. $4.80(ph), $2.70(mf) OTS.

The Higgins continuous ion exchange contactor and other continuous ion exchange contactors are superior to fixed bed ion exchange units. The operation, design and cost comparison of the two types of units are discussed. (auth)

**10848** CF-58-9-63
Oak Ridge National Lab., Tenn.
USE OF 95% NITRIC ACID IN TITANIUM VESSELS. A. Fitch. Sept. 5, 1958. 7p. Contract [W-7405-eng-26]. $1.80(ph), $1.80(mf) OTS.

A literature survey was made to define the maximum safe concentration of nitric acid in titanium process equipment. Acid initially containing 2% more of water and 3% or less of $NO_2$ appears to be safe to use in the Darex process. (auth)

**10849** CF-58-12-55
Oak Ridge National Lab., Tenn.
VOLATILITY PILOT PLANT MODIFICATIONS—HYDROGEN FLUORIDE CONDENSERS, FV-2004, FV-2005. S. Mann. Dec. 8, 1958. 9p. Contract [W-7405-eng-26]. $1.80(ph), $1.80(mf) OTS.

Off-gas from the hydrofluorinator will be cooled and 94% of the hydrogen fluoride condensed by two heat exchangers connected in series. The first unit, water-cooled, discharges gas and condensed vapor at 50 to 65°F. The second unit, freon-cooled, discharges condensed vapor and noncondensable hydrogen and nitrogen at −60 to −75°F. This report concerns a design description of the condensers and a heat transfer evaluation. The condensers will be fabricated at ORNL. (auth)

**10850** HW-32710(Del.)
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
PRELIMINARY REPORT ON THE X-RAY PHOTOMETRIC ANALYSIS OF PLUTONIUM IN CONCENTRATED NITRATE SOLUTIONS. D. M. Newell. Jan. 17, 1955. Decl. with deletions Dec. 4, 1958. 5p. Contract W-31-109-Eng-52. $1.80(ph), $1.80(mf) OTS.

The method adopted makes use of an existing technique which has been successful for the analysis of uranium in the presence of many impurities. Using a high concentration of salting agent (55% aluminum nitrate nonahydrate) and an acidity of 1.5 N $HNO_3$, the plutonium is extracted quantitatively into TBP. A 30% tributyl phosphate in high-purity kerosene (as Deobase) is used. The organic layer is transferred to glass cells with 12 mm path length and read in the x-ray photometer. The interferences in the method are uranium and lanthanum; however, the latter shows no detectable effect except when present at greater than 3% of the plutonium concentration. (auth)

**10851** HW-58750
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
FLUORESCENT X-RAY SPECTROGRAPHY—A RECENT ANALYTICAL TECHNIQUE. M. C. Lambert. Dec. 17, 1958. 19p. Contract W-31-109-Eng-52. $3.30(ph), $2.40(mf) OTS.

X-ray spectrography is applicable to both qualitative and quantitative determinations of all elements heavier than sodium. The method is described, and its advantages and limitations are discussed. Typical analyses are mentioned, and sensitivity limits for the determination of the various elements are illustrated. (auth)

**10852** HW-59193
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
CONCENTRATION AND FINAL PURIFICATION OF NEPTUNIUM BY ANION EXCHANGE. J. L. Ryan. Feb. 10, 1959. 15p. Contract W-31-109-Eng-52. $3.30(ph), $2.40(mf) OTS.

The final separation and purification of Np from Pu, U, fission products, Th, and common metallic impurities were investigated. It was found that Np(IV) can be absorbed on anion exchange resins from 6 M $HNO_3$ containing ferrous sulfamate and hydrazine. Procedure for eluting other metals from the resin are given as well as separation efficiencies. The choice of resin is listed along with elution techniques and a flowsheet. (J.R.D.)

**10853** IGR-TN/S-1032
United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.
MEASUREMENT OF POWDER SURFACE AREAS BY KRYPTON ADSORPTION. L. Tomlinson. 1959. 8p.

An apparatus was designed to measure surface areas of powders with values varying from 0.02 to 4 $m^2/g$ using small samples of 0.5 to 2 g. Krypton was used as an adsorbate at liquid nitrogen temperatures, and the results showed good agreement with those obtained by nitrogen adsorption. (auth)

**10854** ISC-993
Ames Lab., Ames, Iowa.
ELASTIC CONSTANTS OF THORIUM SINGLE CRYSTALS. Philip E. Armstrong and O. N. Carlson. June 1957. 109p. Contract W-7405-eng-82. $2.50(OTS).

Values for the elastic constants $c_{11}$, $c_{12}$, and $c_{44}$ of thorium were determined over the temperature range from 80 to 370°K by ultrasonic measurements on single crystals. Two crystals were prepared by the strain anneal method. One crystal was cut in the form of a circular plate about 0.7 inch in diameter and 0.06 inch thick. The [111] direction of the crystal was perpendicular to the sample face. Measurements on this crystal with a resonance technique produced values for the stiffness coefficient in the [111] direction. This stiffness coefficient is a function of all three elastic constants: $Q\,[111] = \frac{1}{3}(c_{11} + 2c_{12} + 4c_{44})$. The other crystal was in the form of a plate 0.28 inch thick, 0.5 inch wide, and 1.0 inch long. The direction perpendicular to the 0.5 by 1.0 inch face was found to lie between the [111] and [100] directions and close to the $(0\bar{1}1)$ plane by the back reflection Laue x-ray method. The cosines of this direction were determined. Measurements of the velocities of the longitudinal mode and the two shear modes that could be propagated in this direction were obtained by the ultrasonic pulse-echo technique. Trial values for the elastic constants were calculated from the direction cosines and the velocity measurements, using a perturbation solution of the equations of motion in a skew direction. These elastic constants were used to calculate values for the stiffness coefficient in the [111] direction. These values were compared with the results obtained from the resonance method. The differences were assumed to be caused by systematic transit time errors in the pulse-echo method. Allowance for these systematic errors was made by applying small corrections to the measured echo transit times, in proportion to the magnitudes of the times. The corrected transit times were used to calculate velocities from which values were obtained for the elastic constants. At 300°K, $c_{11} = 7.53 \times 10^{11}$ dyne-$cm^{-2}$, $c_{12} = 4.89 \times 10^{11}$ dyne-$cm^{-2}$, and $c_{44} = 4.78 \times 10^{11}$ dyne-$cm^{-2}$. The maximum uncertainty in these values is about one per cent. A value of compressibility of $17.3 \times 10^{-13}$ $cm^2$-$dyne^{-1}$ and a value of the anisotropy term, $(2c_{44}/c_{11}{}^{-c_{12}})$, of 3.62 were calculated from the elastic constants. (auth)

**10855** NAA-SR-Memo-858
North American Aviation, Inc., Downey, Calif.
CHEMICAL REACTIONS BETWEEN WATER AND CERTAIN METALS AT ELEVATED TEMPERATURES. Paper Presented at Joint United Kingdom, United States, Canadian Conference on Safety of Reactors, Chalk River, Canada, October 13, 1953. Harry Pearlman. Jan. 12, 1954. Decl. Nov. 6, 1958. 22p. $4.80(ph), $2.70(mf) OTS.

Thermodynamic data predict that large negative free-energy changes will attend the reaction of water with various metals which are of interest as nuclear reactor materials. Experimental investigations of the reactions have utilized a variety of procedures for initiating reaction: pouring a melt into water; autoclave and other slow methods of heating; exploding metals into water with booster charges; and disrupting metals by passing large electrical currents through them. Although at least some of the available evidence is conflicting, it appears certain that under the proper conditions of initiation explosive chemical reactions can be induced between water and the following metals: aluminum, magnesium, aluminum-uranium alloy (10% and 25% U) uranium, zirconium and aluminum-lithium alloy (3-½% Li). Nickel could not be made to react appreciably. These results are in accordance with the thermodynamic data for the schematic reaction: metal + water = oxide (or hydrated oxide), + hydrogen. It appears that explosive chemical reaction with water may occur in thermodynamically favorable cases, either when the metal is initially dispersed into a finely divided state or under certain other circumstances. (auth)

**10856** NYO-2182
New York Univ., New York.
SOLUTIONS OF ALKALI METALS IN POLYETHERS AND VAPOR PRESSURES OF ALKALI METALS. Benson R. Sundheim and Fred Cafasso. Mar. 9, 1959. 124p. Contract AT(30-1)-1937. $19.80(ph), $6.30(mf) OTS.

The absorption spectra, electron paramagnetic resonance spectra, electrical conductivity, and some solubility relationships have been studied in alkali metal—ether systems. The results are compared to the chemical, optical, and magnetic properties of similar solutions in liquid ammonia or amine solvents, in order to determine the general nature of the ether solutions. (W.L.H.)

**10857** RISLEY-5217
United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.
THE DETERMINATION OF PHOSPHORUS AND ARSENIC IN URANIC COMPOUNDS. C. D. Lafferty and P. Wade. July 19, 1954. 20p. (ARDC/P-21).

A method is presented for the determination of microgram amounts of both arsenic and phosphorus, limited to the application of the molybdenum blue technique directly to solution of uranium or its compounds. (auth)

**10858** SRS-14
Gt. Brit. Springfields Works, Springfields, Lancs, England.
SOME PHYSICAL AND CHEMICAL PROPERTIES OF CHLORINE TRIFLUORIDE AND URANIUM HEXAFLUORIDE. E. H. Pritchard. June 12, 1951. 7p.

**10859** UCRL-8601
California. Univ., Berkeley. Lawrence Radiation Lab.
THE VAPOR PRESSURE OF NITROBENZENE AT LOW TEMPERATURES. Edward J. Lynch and Charles R. Wilke. Jan. 14, 1959. 9p. Contract W-7405-eng-48. $0.50(OTS)

The vapor pressures of nitrobenzene were measured over a range of temperatures from 6 to 23°C and at atmospheric pressure using a packed-bed technique. The data could be correlated to the following relationship: $\log_{10} p_{mm} = 7.545 - (2064/t + 230)$. (auth)

**10860** WADC-TR-57-294(Pt. II)
General Electric Co. Light Military Electronics Dept., Schenectady, N. Y.
RESEARCH ON LIQUID METALS AS POWER TRANSMISSION FLUIDS. Robert C. Kumpitsch. Feb. 1, 1959. 178p. Project title: SECONDARY POWER COMPONENTS AND MATERIALS. Task title: HYDRAULIC FLUIDS. Contract AF33(616)-3698.

The behavior of liquid metal NaK-77 (a eutectic alloy of sodium 23% by weight and potassium 77% by weight) as a hydraulic fluid was observed over a temperature range of 80°F to 1000°F and at cyclic pressures of 15 psia to 3000 psia. An evaluation was made of several bearing and construction materials and several types of static seals to determine their effectiveness in NaK-77 under such conditions of operation. Capillary and orifice flow characteristics were obtained with this fluid and a correlation was made of these test results with the calculated results. A single piston test pump operating in an inert atmosphere "glove box" has pumped NaK-77 to pressures of 3000 psi at 1000°F and delivered a cyclic flow rate of 0.02 GPM. A total of 368 hours of NaK pumping have been accrued, two and one-half hours of which were at temperature and pressure. Various material combinations, clearances, orifice characteristics and static seals were successfully evaluated. Materials compatibility tests were conducted with friction and wear test equipment in NaK-77 at 1000°F. A total of 19 tests were conducted, nine for the calibration of the test equipment, and ten tests to evaluate the five most promising material combinations. Test results essentially confirmed previous work conducted by others in which carbide materials appear to be the most compatible combinations in NaK-77 at 1000°F ambients. A high pressure (3000 psi) and temperature (1000°F) test loop was also designed to circulate NaK-77 at a flow rate of 1 GPM for purposes of evaluating the feasibility of using liquid metals as a hydraulic fluid for power transmission and control systems applications. The design of this test loop also included the design of a 1000°F, 3000 psi, 1 GPM continuous flow, staged gear pump as a prime mover. (auth)

**10861** WADC-TR-55-221(Pt. V)
Hooker Chemical Corp., Niagara Falls, N. Y.
FLUORINE-CONTAINING CONDENSATION POLYMERS AND RESINS. [Period covered] April 1, 1958 to January 1959. Carl J. Verbanic, David Knutson, John E. Wier, Edward V. Gouinlock, and C. Thomas Bean. Jan. 1959. 60p. Project title: RUBBER, PLASTIC, AND COMPOSITE MATERIALS. Task title: SYNTHESIS AND EVALUATION OF NEW POLYMERS. Contract AF33(616)-5548.

With this is bound Appendix I: Purdue Univ., Lafayette, Ind. MONO- AND BIFUNCTIONAL FLUOROHYDROCARBONS. Annual Report [for] November 1, 1957 to December 1, 1958. Earl T. McBee.

Polyesters and polyester resin laminates were prepared using fluorinated glycols as a component of the polyester. The laminates were aged at elevated temperatures and physical properties measured before and after aging. Comparison of these aging results with polyesters containing hydrocarbon glycol components of the same carbon chain length indicate a noticeable improvement in retention of physical properties of the fluorinated materials over the hydrocarbon analogues. In addition, the research performed on the preparation of certain fluorine-containing compounds for use as starting materials for the preparation of polyesters and cross-linking monomers is described. A new and improved synthesis of perfluoroglutaronitrile is described and efforts to improve the yields of the dehydration of perfluoroglutaramide are given. Results of research on the synthesis of certain novel or unusual fluorine-containing intermediates considered desirable for polymerization in this project are included. (auth)

**10862** WAL-TR-425/1
Watertown Arsenal Lab., Mass.
SPECTROPHOTOMETRIC DETERMINATION OF MOLYBDENUM IN URANIUM ALLOYS. E. F. Jacobson. Apr. 1959. 12p. DA Project No. 512-15-018. (AD-212551).

The spectrophotometric thiocyanate determination of molybdenum without extraction was applied to uranium alloys. It was shown to be rapid, accurate, and free from interferences by alloying elements. A detailed procedure is given for the determination of molybdenum in uranium alloys. (auth)

**10863** WAPD-FE-848(Rev.2)
[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.]
PURCHASING SPECIFICATION FOR $UO_2$ FOR FIRST PWR CORE. July 14, 1955. Decl. April 26, 1957. 8p. Contract AT-11-1-GEN-14. $1.80(ph), $1.80(mf) OTS.

Purchasing specification for the first PWR core $UO_2$ is presented. The specification covers manufacturing process, as well as chemical and physical requirements for commercially pure natural $UO_2$. (J.R.D.)

**10864** Y-1235
Union Carbide Nuclear Co. Y-12 Plant, Oak Ridge, Tenn.
DEVELOPMENT IN POROUS METAL MEDIA FOR GAS FILTRATION. R. P. Levey, Jr. Feb. 12, 1959. 26p. Contract W-7405-eng-26. $1.00(OTS).

The design and development of high-strength, low-pressure-drop, corrosion-resistant metal elements with superior blowback properties for gas filtration in several applications are described. Performance characteristics of the new media are compared with those of several commercial items. (auth)

**10865** AEC-tr-3583
RESEARCH ON THE ELECTROCHEMICAL BEHAVIOR OF METALLIC SINGLE CRYSTALS. Notes 1, 2, and 3. (Ricerche sul Comportamento Elettrochimico di Monocristalli Metallici.) R. Piontelli, U. Bertocci, L. Bicelli, G. Poli, B. Rivolta, G. Sternheim, and C. Tamplenizza. Translated for Oak Ridge National Lab. from Rend. ist. lombardo sci. 91, 347-54; 355-70; 378-85(1957). 59p. (Includes original, 32p.). $15.30 (ph), $5.40(mf) JCL or LC.

Techniques for investigating the electrochemical behavior of metallic single crystals were developed. Samples were prepared from pure metals by a modified Bridgman method, followed by orientation and surface polishing. Anodic and cathodic overvoltages were measured in suitable cells such as Cu and Ag at 25°C in the presence of various solutions and current densities. In addition, the hydrogen overvoltages on Cu single crystals in $H_2SO_4$ were measured at 25, 40, and 55°C. Methods are described, and discussions of results as well as conclusions are presented. (J.R.D.)

**10866** AEC-tr-3630
THE DETERMINATION IN AIR AND DILUTE SOLUTIONS OF SMALL AMOUNTS OF AMINES PRODUCED FROM AROMATIC ISOCYANATES IN THE PRESENCE OF THE ISOCYANATES. W. Pilz. Translated for Los Alamos Scientific Lab. from Mikrochim. Acta No. 4, 545-52(1958). 7p. $1.80(ph), $1.80(mf) JCL or LC.

Aromatic isocyanates react quantitatively with secondary aliphatic amines in dimethylformamide to yield ureas, whereas there is no reaction with aromatic amines provided an excess of aliphatic base is present. In mineral acid solution there is no reaction with either aromatic or aliphatic amines; instead there is quantitative saponification to the corresponding amines. In moist air aromatic isocyanates are stable in the presence of the amines they have yielded. Likewise, the corresponding amines can exist, without reacting with the isocyanates, in dilute solutions of aromatic isocyanates in organic solvents. Instances are given for both cases. Analytical procedures are provided. (auth)

**10867** AEC-tr-3631
THE CONTINUOUS DETERMINATION OF THE CONCENTRATION OF NITRIC OXIDE IN COKE OVEN GAS. M. T. Borok. Translated for Los Alamos Scientific Lab. from Zavodskaya Lab. 23, 1414-20(1957). 6p. $1.80(ph), $1.80(mf) JCL or LC.

A gas analyzer for the continuous analysis of nitric oxide content in coke oven gas was developed for the range 0 to 18 $cm^3$ NO/$m^3$. The NO is oxidized to $NO_2$ by addition of ozone. The resulting gas is determined colorimetrically with metaphenylenediamine. Modification of the ozone addition apparatus ensures freedom from reaction tube fouling which occurred in earlier designs. Design descriptions as well as calibration and experimental test analyses are given. (J.R.D.)

**10868** AEC-tr-3633
THE ACIDITY OF CERTAIN MINERAL ACIDS IN ACETIC ACID. THE ACIDITY FUNCTION $(H_0)_I$. Jan Rocek. Translated for Argonne National Lab. from Chem. listy 50, 726(1956). 14p. $3.30(ph), $2.40(mf) JCL or LC.

A study was made in which the designation of a specific basic indicator (I) is associated with the Hammett acidity function $H_0$ as $(H_0)I$. The properties of these functions and their relation to the general function $H_0$ are discussed. In addition, the acidities of $H_2SO_4$, $HClO_4$, and $H_3PO_4$ containing moisture were measured in acetic acid. (J.R.D.)

**10869** AEC-tr-3635
CONCERNING THE ELECTROLYTIC DEPOSITION OF METALLIC NIOBIUM AND ITS SEPARATION FROM TANTALUM. N. Izgaruishev (Isgarischew) and A. F. Prede. Translated by H. P. Raaen (Oak Ridge National Lab.) from Z. Elektrochem. 39, 283-8(1933). 15p. $3.30(ph), $2.40(mf) JCL or LC.

A procedure is described for the production of a Nb-Ta pentoxide mixture from raw materials from which an acid electrolyte can be produced for electrodeposition of Nb, the Ta remaining in solution. Also, an alkaline process was developed for galvanic type Nb plating. Applications for both electrolytic methods are outlined as well as properties of the plate and pure metal deposits. (J.R.D.)

**10870** AERE-Trans-11/3/5/1165
A SIMPLIFIED METHOD OF SPECTRAL ANALYSIS OF INERT GASES FOR PURITY. O. P. Bochkova, L. P. Razumovskaya, and S. E. Frish. Translated by L. Bovey (U.K.A.E.A. Atomic Energy Research Establishment) from Optika i Spektroskopiya 5, 93(1958). 5p. $1.80(ph), $1.80(mf) JCL or LC.

A photoelectric method for spectral analysis of commercial gases is described. The procedure is outlined, and applications are pointed out. Removal of interfering gases is discussed. (J.R.D.)

**10871** AERE-Lib/Trans-809
THE THERMAL CONDUCTIVITY OF ORGANIC HEAT TRANSFER MEDIA OF HIGH BOILING POINT. V. V. Kerzhentsev and N. B. Vargaftik. Translated by J. B. Sykes (U.K.A.E.A., Atomic Energy Research Establishment) from Khim. Prom, No. 3, 82-4(1950). 7p.

A formula is proposed for calculating the thermal conductivity of an organic heat transfer medium of high boiling point. The thermal conductivity of Dowtherm at 20 to 400°C was studied. The method of investigation is given, and results are tabulated. The proposed thermal conductivity formula change is based on these data. (J.R.D.)

**10872** CEA-tr-R-261
COURANT POLAROGRAPHIQUE-CATALYTIQUE DE MOLYBDENE ET SON UTILISATION EN VUE DE LA DÉTERMINATION DE MICROQUANTITES DE MOLYBDENE. (Polarographic-Catalytic Current of Molybdenum and its Utilization for the Determination of Microquantities of Molybdenum.) S. I. Sinyakova (Siniakova) and M. I. Glinkina. Translated into French from Zhur. Anal. Khim. 11, 544-52(1956). 22p.

The catalytic wave of Mo in NaClO$_4$–H$_2$SO$_4$ and in HClO$_4$–H$_2$SO$_4$ was studied. It was found that the limiting current of Mo in these solutions depended neither on the Hg-column pressure nor on H$_2$SO$_4$ concentration, but on HClO$_4$ concentration and was therefore kinetically limited. The Mo catalytic current was conditioned by reoxidation of the Mo$^{4+}$ obtained during electrolytic reduction of Mo$^{5+}$ aided by HClO$_4$. Thus, using a standardization curve, Mo can be quantitatively determined in concentrations down to 10$^{-6}$ M with a relative error not exceeding ±10%. A method for determining Mo in rocks is given which is based on extraction of the Mo–α–benzoinoxime complex by CHCl$_3$ followed by polarography. (T.R.H.)

**10873** CEA-tr-R-282
COMBINAISONS DE CERTAINS ÉLÉMENTS DES TERRES RARES AVEC DES THIOSULFATES. (Combinations of Some Elements of the Rare Earths with the Thiosulfates.) D. I. Riabtchikov and V. Volkova. Translated into French by H. Yavlensky from Doklady Akad. Nauk S.S.S.R. 55, 505-8(1947). 8p.

Investigation of the preparation and properties of rare earth thiosulfates is reported. The thiosulfates are formed by reaction of the chloride with Na$_2$S$_2$O$_3$ in aqueous solution, and extracted with CH$_3$OH. They are not very stable and decompose to sulfites and S. Their solubility in water and other differences in behavior make separations possible. (T.R.H.)

**10874** CEA-tr-R-344
SUR LES MÉTHODES DU DOSAGE DU FLUOR DANS LES SILICATES. (Methods for the Determination of Fluorine in Silicates.) Yu. V. Moratchevskii (Moratchevski) and E. N. Egorova. Translated into French from Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk No. 11, 1320-8(1956). 15p.

Methods for determining F in siliceous materials are reviewed. It is shown that in the colorimetric determination of F by the sulfonic acid alizarin–Zr lake method silica interferes by holding the Zr and diminishing the red component of the color. To eliminate the error, the silica is determined in an aliquot, and this amount of silica is put into the standard fluoride solution. It was found that during Na fusion of the sample, in the absence of silica and alumina, the F dissolves and is extracted better with a small addition of silica, several times smaller than that ordinarily recommended. If Al is present, complete dissolution of F is obtained only if the amount of silica exceeds that of alumina. In separation of F as lead fluochloride the presence of SiO$_2$ slows the precipitation and for high proportions of SiO$_2$ makes the separation of F incomplete. A proposed variation of the method for high F concentrations in siliceous materials consists of volumetric determination in the solution and colorimetric determination in the precipitate. (T.R.H.)

**10875** CEA-tr-R-589
LIMITES D'UTILISATION D'UNE EQUATION CINETIQUE DE PREMIER ORDRE POUR LES REACTIONS D'ECHANGE ISOTOPIQUE. (Limits of Utilization of a Kinetic Equation of the First Order for Isotopic Exchange Reactions.) Ya. M. Varshavskii and S. E. Vaisberg. Translated into French from Zhur. Fiz. Khim. 32, 454-9(1958). 14p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 10383.

**10876** CEA-tr-R-590
SENSIBILITÉ ABSOLUE DE LA DETERMINATION DES TERRES RARES. (Absolute Sensitivity of the Determination of the Rare Earths.) T. N. Zhigalovskaya (Jigalovskaia). Translated into French by B. de Trezvinsky from Izvest. Akad. Nauk S.S.S.R., Ser. Fiz. 19, 115(1955). 3p.

The spectrography of elements with their s-level filled (Mg, Ca, Sr, and Ba) their d-levels filled (Cr, Nb, W, Mn, Mo, Re, Y, and La), and their f-levels filled (Ce, Pr, Nd, Sn, Yb) was studied to establish the absolute sensitivity limits for determination of rare earths. The limit was found to depend on the element's position in the periodic chart. For a given value of the l quantum number, the limit of sensitivity increased with increasing n quantum number. For given values of l and n the limit is as much higher than the number of electrons in the outer orbit as the number in the outer orbit differs from the number necessary for the outer layer to be filled or partially filled. The limit depends considerably, too, on the presence of other elements. (T.R.H.)

**10877** CEA-tr-R-595
DÉTERMINATION DU POUVOIR DE REFROIDISSEMENT DE SELS FONDUS. (Determination of the Coolant Efficiency of Fused Salts.) D. Ya. (Ia.) Vichniakov and A. A. Neoustrouev. Translated into French by B. de Trezvinsky from Zavodskaya Lab. 24, 63-5(1958). 8p.

The cooling power of fused salts was determined from heat transfer coefficients. NaNO$_3$, NaNO$_2$, and a 45% NaNO$_3$–55% KNO$_3$ mixture were used at temperatures 270, 320, 370, 420, 470, 520, and 570°C. A 50-mm-diam spherical sample of steel was preheated in BaCl$_2$ to 110°C then introduced into the fused salt. The temperature rise of the fused salt bath was less than 5°. The temperature at the center of the steel sample was measured with a Pt–PtRh thermocouple. The heat transfer coefficient was calculated on the basis of a regular thermal zone theory. The average value of heat transfer coefficient, during the cooling period, was found to be 600 to 800 kcal/m$^2$ hr °C, for a superheating temperature of 150 to 250°C for the salt. (T.R.H.)

**10878** CEA-tr-R-597
A PROPOS DE L'EQUILIBRE $UI_4 \rightleftharpoons UI_3 + I$. (The Equilibrium $UI_4 \rightleftharpoons UI_3 + I$.) M. M. Popov and M. D. Senin (Senine). Translated into French from Zhur. Neorg. Khim. 2, 1479-81(1957). 8p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 17040.

**10879** CEA-tr-R-602
ANALYSE SPECTROGRAPHIQUE DE LA TENEUR EN SILICIUM, EN ALUMINIUM ET EN FER DANS LE CHROME METALLIQUE. (Spectrographic Analysis of the Content of Silicon, Aluminum, and Iron in Metallic Chromium.) I. A. M. Kalinskii (Kalinsky). Translated into French from B. de Trezvinsky from Zavodskaya Lab. 24, 755(1958). 4p.

A spectrographic analysis of Cr for Al, Fe, and Si is described. The spectrograph used is described. The 3-standard method was used, the spectral line pairs being: Si 2506.90 – Cr 2504.31, Al 3082.15 – Cr 3077.83, and Fe 2599.40 – Cr 2591.85. The method is faster than chemical methods. (T.R.H.)

**10880** CEA-tr-R-603
CO-PRECIPITANTS ORGANIQUES (VIII). CO-PRECIPITATION DE L'URANIUM POUR SON DOSAGE DANS L'EAU DE MER. (Organic Coprecipitants. VIII. Coprecipitation of Uranium for its Determination in Sea Water.) V. I. Kuznetsov and A. A. Akimova. Translated into French from Zhur. Anal. Khim. 13, 79-82(1958). 11p.

The precipitation and separation of U from sea water are described. Addition of $NH_4SCN$ and methyl violet to acidified sea water causes a precipitate to form which carries down U, even for dilutions of $1:10^{10}$. The deposit is then filtered and calcined, thus obtaining U separated from other sea water salts. (T.R.H.)

**10881** CEA-tr-R-608
ECHANGE ISOTOPIQUE DU SOUFRE DANS LE SELS DES ACIDES THIO-SULFO-ORGANIQUES. (Isotopic Exchange of Sulfur in Salts of Thio-Sulfo Organic Acids.) N. I. Grishchko (Grischko) and E. N. Guryanova (Gurianova). Translated into French from Zhur. Obshchei Khim. 28, 1287-95(1958). 24p.

The exchange of S between various thiosulfonic salts ($RSO_2SMe$) and elementary $S^{35}$ in a toluene–alcohol solution was studied at different temperatures. The activation energies were determined. The effects of the radical and the metal on the exchange capacity of the salts were shown, and the effects of the composition and structure of the radical were analyzed. The electric conductivity and dissociation constants of the thiosulfonic salts at various concentrations in alcohol–toluene solution were measured. The mechanism of the exchange reaction is discussed. (T.R.H.)

**10882** GAT-T-646
TREATMENT OF GASEOUS URANIUM HEXAFLUORIDE BY MEANS OF AN INVERSE MOLECULAR FORCE MODEL. Jaun A. McMillan. Translated by A. L. Cardenas (Goodyear Atomic Corp.) from Publs. com. nacl. energía atomica (Buenos Aires) Ser. fis. 1, No. 3 (1954). 6p. $0.50(OTS).

This paper was previously abstracted from the original language and appears in NSA, Vol. 9, as abstract No. 4657.

**10883** SCL-T-234
THE HYDROGEN ADSORPTION PROPERTIES OF METALS AS A FUNCTION OF THEIR POSITION IN THE MENDELEYEV PERIODIC SYSTEM OF ELEMENTS. (Zavisimost' Adsorbtsionnykh Svoistv Metallov po Otnosheniyu K Vodorodu ot ikm Polozhenia v Periodicheskoi Sisteme Elementov D. I. Mendeleeva.) N. N. Kavtaradze. Translated by Marcel I. Weinreich (Sandia Corp.) from Zhur. Fiz. Khim. 32, 1214-17(1958). 8p. $1.80(ph), $1.80(mf) JCL or LC.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 1983.

**10884**
ON THE COMPLEX CHEMISTRY OF THE TERVALENT RARE EARTH IONS. II. THE ACETATE SYSTEMS OF PRASEODYMIUM, SAMARIUM, DYSPROSIUM, HOLMIUM, ERBIUM, AND YTTERBIUM. Artur Sonesson (Univ. of Lund). Acta Chem. Scand. 12, 1937-54(1958).

Six rare earth acetate systems were examined potentiometrically and one extinctiometrically. The complexity and stability constants are listed. All measurements were performed in perchlorate medium of ionic strength 2 M at 20°C. The extinctiometric investigation of the $Er^{3+}-Ac^-$ system shows that the formation of the acetate complexes is accompanied by the appearance of new peaks close to the original absorption bands at about 380 mμ and 525 mμ. The new peaks, one at every band, have a somewhat shorter wavelength than the original peaks. The agreement between the potentiometrically and the extinctiometrically obtained complexity constants is good. The stability constant of the first complex, $b_1$, increases with the atomic number from La to Sm. Then it decreases for Gd and Dy and remains approximately constant for Dy, Ho, Er, and Yb. To begin with, $b_2$ and $b_3$ also increase with the atomic number of the rare earth. For the heaviest rare earths, however, $b_2$ and $b_3$ decrease slightly. The heavier rare earths (Gd–Yb) seem to form polynuclear complexes which, however, are rather weak. (auth)

**10885**
SYNTHESIS OF BASTNAESITE. George J. Jansen, George B. Magin, Jr., and Betsy Levin (U. S. Geological Survey, Washington, D. C.). Am. Mineralogist 44, 180-1(1959) Jan.-Feb.

An attempt was made to synthesize bastnaesite. Seven of the runs were successful. Attempts to synthesize the rare-earth fluocarbonates directly from rare-earth nitrates were unsuccessful. For successful runs the carbonate was first prepared by the reaction of the particular rare-earth nitrate with sodium carbonate. Identification of the natural and synthetic bastnaesite was made by the x-ray powder diffraction patterns. (auth)

**10886**
BEHAVIOR OF ZIRCONIUM-95 AND NIOBIUM-95 IN DILUTE HYDROCHLORIC ACID TOWARD CATION EXCHANGE RESIN. Seishi Yajima (Japan Atomic Energy Research Inst., Tokyo). Bull. Chem. Soc. Japan 31, 699-704(1958) Sept.

By passing 0.2N hydrochloric acid solution of tracer amounts of $Zr^{95}$ and $Nb^{95}$ (about $10^{-11}$ mole/l, $10^{-13}$ mole, or 1 μc, with respect to each nuclide) through a cation exchange resin column (Dowex 50-X8, Amberlite IR-120, or Diaion SK) and eluting with 0.2N hydrochloric acid, a fraction containing mainly $Nb^{95}$ was obtained. A fraction containing mainly $Zr^{95}$ was then obtained by eluting with 0.5% oxalic acid or 3N hydrochloric acid. With higher concentrations of nonactive zirconium and niobium (about $10^{-6}$ mole/l each), similar results were also obtained. As the 0.2N hydrochloric acid solution of $Zr^{95}-Nb^{95}$ became aged, the adsorbability of $Zr^{95}$ decreased. Effect of hydrochloric acid concentration on the adsorbability of $Zr^{95}$ and $Nb^{95}$ was studied, and the concentration range 0.1 to 0.3N was found to be suitable for separation. The adsorbability of $Nb^{95}$ increased with an increase in the concentration of strontium ion. (auth)

**10887**

GAS CHROMATOGRAPHIC SEPARATION OF HYDROGEN ISOTOPES $D_2$ AND HD. Sumio Ohkoshi, Yuzaburo Fujita, and Takao Kwan (Hokkaido Univ., Sapporo, Japan). Bull. Chem. Soc. Japan 31, 770-1 (1958) Sept.

Gas chromatography is shown to be a new tool for quantitative as well as qualitative analysis of hydrogen isotopes. It is possible to proceed to the determination of the amount of $D_2$, HD, and $H_2$ for a given volume of the mixture, if appropriate data are arranged. (T.B.A.)

**10888**

GAS CHROMATOGRAPHY AS A NEW TOOL FOR ANALYSES OF HYDROGEN ISOTOPES. Sumio Ohkoshi, Shoko Tenma, Yuzaburo Fujita, and Takao Kwan (Hokkaido Univ., Sapporo, Japan). Bull. Chem. Soc. Japan 31, 772(1958) Sept.

It is shown that gas chromatographic techniques are convenient and powerful to analyze the amount of $D_2$, $HD_2$, and $H_2$ for both qualitative and quantitative purposes. The mass spectrometric method may be replaced to a certain extent by the gas chromatographic methods. (T.B.A.)

**10889**

ENRICHMENT OF DEUTERIUM BY LOW TEMPERATURE GAS ADSORPTION CHROMATOGRAPHY. Sumio Ohkoshi, Shoka Tenma, Yuzaburo Fujita, and Takao Kwan (Hokkaido Univ., Sapporo, Japan). Bull. Chem. Soc. Japan 31, 773-4(1958) Sept.

Experimental procedures and data are given which show that low-temperature gas adsorption chromatography is extremely efficient and very simple to enrich deuterium from a mixture of $H_2$, HD, and $D_2$. (T.B.A.)

**10890**

THE OXYTELLURIDE OF CERIUM $Ce_2O_2Te$. Louis Domange, Jean Flahaut, and Abbas Naderi Chirazi (Laboratoire de Chimie Minérale, Paris). Bull. soc. chim. France No. 1, 150-2(1959) Jan. (In French)

An oxytelluride of cerium with the composition $Ce_2TeO_2$ is obtained by the reaction of tellurium gases on the oxide $CeO_2$ at 1000°C. The principal physical and chemical properties are described. It is in particular very resistant to the action of acids and bases and is only attacked by boiling aqua regia and fused potassium hydroxide. It deteriorates slowly in air at room temperature and is sensitive to the action of oxidants. (tr-auth)

**10891**

INVESTIGATIONS ON THE BORINATION OF METALLIC POWDERS BY BORON CHLORIDE. W. J. Deiss and J. L. Andrieux (École Nationale Superieure d'Électrochimie et d'Électrométallurgie, Grenoble, France). Bull. soc. chim. France No. 1, 178-82(1959) Jan. (In French)

An investigation of the borination of metallic powders by boron chloride in a hydrogen or argon atmosphere was made. The metals molybdenum, tungsten, titanium, zirconium, aluminum, magnesium, and beryllium were used. The effects of the partial pressure of the constituents of the initial gaseous mixture, the temperature, and the length of the reaction on the nature of the borides obtained and on the boron yield were determined. Molybdenum and tungsten borides with no chloride contamination could be produced. The borination of the light metals gave unstable borides and finally amorphous boron, more or less pure. (J.S.R.)

**10892**

PURIFYING ROUTE TO NUCLEAR-GRADE GRAPHITE. C. S. Cronan. Chem. Eng. 66, No. 4, 114-17(1959) Feb. 23.

A flowsheet for production of high-purity graphite is presented. Low-boiling impurities are removed by graphitization at 5000 to 5400°F. To free the graphite of the high-boiling impurities such as boron and vanadium, Freon-12 gas is forced through the graphitizing-furnace bed. The freon decomposes to form free chlorine and fluorine which react with the boron and vanadium resulting in volatile fluorides and chlorides which discharge from the furnace. High-purity graphite containing one part in ten million boron remains. (J.R.D.)

**10893**

APPLICATION OF THE LANGMUIR ISOTHERM TO THE MIXED ADSORPTION OF LANTHANIDE AND HYDROGEN IONS. Jacqueline Belloni. Compt. rend. 248, 1322-5(1959) Mar. 2. (In French)

It was established that the adsorption of Pm (+Sm) and of radiocerium on Pt follows the Langmuir isotherm. By admitting, according to the pH effect, that $H^+$ ions follow the same law, the characteristic adsorption constants for the lanthanides examined (Pm, Sm, and Ce) and $H^+$ ions were calculated. The mechanism of the processes is discussed. (tr-auth)

**10894**

A RECOVERY SCHEME FOR POISONED ION EXCHANGE RESINS. Mayer B. Goren (Kerr-McGee Oil Industries, Inc., Oklahoma City). Ind. Eng. Chem. 51, 539-42(1959) Apr.

Recovery of uranium by ion exchange process has led to resin poisoning problems stemming from irreversible sorption or deposition of substances present in minor quantities in leach liquor. In the Colorado Plateau area molybdenum, zirconium, titanium, and phosphate are the principal poisoning agents. Resins can be economically restored to their original loading and eluting characteristics by alternate treatment with strong acid and moderately strong alkali, the most efficient process involving alkaline treatment as a first step. The seemingly drastic treatment is without degradative effect on the resins, and the process is believed to be well suited to the restoration of ion exchange resins poisoned in a variety of processes. (auth)

**10895**

LABORATORY GAS COMPRESSOR FOR PRESSURES UP TO 10,000 P.S.I. F. J. Edeskuty (Los Alamos Scientific Lab., N. Mex.). Ind. Eng. Chem. 51, No. 4, 69A-70A(1959) Apr.

A four-stage mercury-piston pump was built for compression of small amounts of gases to pressures up to 10,000 psi. It is intended for use in a combined vacuum and high-pressure system, so that the pump and the rest of the system can be evacuated both before and after pressuring. The gas being compressed comes in contact only with mercury, steel, and teflon. (W.L.H.)

**10896**

STABILITY OF METAL CHELATES OF 8-QUINOLINOL-5-SULFONATE. C. F. Richard, R. L. Gustafson, and A. E. Martell (Clark Univ., Worcester, Mass.). J. Am. Chem. Soc. 81, 1033-40(1959) Mar. 5.

The interaction of Mn(II), Co(II), Ni(II), Cu(II), Zn(II), Mg(II), Fe(III), UO$_2$(VI), and Th(IV) ions with 8-hydroxyquinoline-5-sulfonate has been investigated by potentiometric and spectrophotometric methods. Formation constants have been calculated for chelates containing 1:1, 2:1 and in some cases 3:1 and 4:1 ratios of ligand to metal ion. Comparison of these stability constants with those obtained for 8-quinolinol itself shows that the observed differences are essentially the result of the lower basicity of the sulfonated ligand. The hydrolytic behavior of Fe(III), UO$_2$(VI), and Th(IV) chelates containing two unfilled coördination positions has been investigated quantitatively. The hydrolysis and olation tendencies of the 3:1 thorium and 2:1 uranyl and ferric chelates were found to follow the order Fe(III) > Th(IV) > UO$_2$(VI). (auth)

**10897**

HYDROLYTIC BEHAVIOR OF METAL IONS. X. ULTRACENTRIFUGATION OF LEAD(II) AND TIN(IV) IN BASIC SOLUTION. James S. Johnson and Kurt A. Kraus (Oak Ridge National Lab., Tenn.). J. Am. Chem. Soc. 81, 1569-72(1959) Apr. 5.

The species formed by amphoteric solutes in basic aqueous media have been described by some as colloidal aggregates and by others as monomers. By equilibrium ultracentrifugation it is established that Sn(IV) and Pb(II) exist as monomeric (mononuclear) species in basic solution. (auth)

**10898**

A STUDY OF THE REACTIONS OF GRAPHITE WITH CARBON DIOXIDE WITH REFERENCE TO GAS-COOLED NUCLEAR REACTORS. T. B. Copestake, H. W. Davidson, and B. L. Tonge (General Electric Co., Ltd., Wembley, Eng.). J. Appl. Chem. (London) 9, 74-84(1959) Feb.

The reaction of graphite and carbon dioxide is discussed in relation to the performance and safety of gas-cooled graphite-moderated nuclear reactors. Reaction is promoted by reactor radiation but this radiation-induced process is unlikely to be temperature dependent. The limiting temperature for operating the system graphite—carbon dioxide is, therefore, probably set by the thermal reaction. A wide variety of experimental means was used to examine the thermal reaction and it is concluded that gasification of carbon dioxide is unlikely below temperatures of 600°. This conclusion appears valid even if applied to graphite which has undergone heavy neutron damage. Accelerated life tests covering several thousand hours were used to confirm these observations. These same tests show that gasification of graphite occurs at temperatures above 600° but is strongly inhibited by the presence of carbon monoxide. This provides an additional factor of safety from the reactor point of view. The most pessimistic estimate for the rate of gasification of graphite in carbon dioxide by purely thermal means at 500° is calculated to be 0.1% (by weight) in 20 years. The carbon monoxide observed after exposing graphite to carbon dioxide at temperatures below 600° arises from the formation of a stable oxide on the carbon surface. Carbon monoxide can reduce this surface oxide at 500° and the clean surface produced will adsorb carbon monoxide. Carbon monoxide in contact with ungraphitized carbon may decompose and deposit carbon. This deposition reaction is not self-propagating and leads to an inert carbon surface. (auth)

**10899**

THE NITRATONITROSYLRUTHENIUM COMPLEX, RuN$_3$O$_{7.5}$. F. S. Martin, J. M. Fletcher, P. G. M. Brown, and B. M. Gatehouse (Atomic Energy Research Establishment, Harwell, Berks, Eng. and University Coll., London). J. Chem. Soc. 76-9(1959) Jan.

The ruthenium compound obtained by the reaction of nitric oxide with ruthenium tetroxide in carbon tetrachloride and referred to as Ru$_2$N$_6$O$_{15}$ by Martin and by Fletcher et al. was studied. Infrared examination included the use of the N$^{15}$ form of the complex. The reactions involved in its preparation and its behavior in both organic and aqueous media indicate that it may be a nitrato-complex containing two bisnitrosylruthenium groups linked by an oxo-bridge. Infrared absorptions of a number of other compounds containing the Ru—O bond are reported. (auth)

**10900**

ORGANIC COMPOUNDS OF ZIRCONIUM. PART VI. REACTIONS OF ZIRCONIUM TETRACHLORIDE AND isoPROPOXIDE WITH FATTY ACIDS. R. N. Kapoor and R. C. Mehrotra (Univ. of Lucknow, India). J. Chem. Soc. 422-6(1959) Jan.

Fatty acids with zirconium tetrachloride give tetracarboxylates directly. With zirconium isopropoxide only oxygen-bridged compounds of the type $(R \cdot CO_2)_3Zr \cdot O \cdot Zr(CO_2R)_3$ are obtained. By studying the latter reaction stepwise, it is found that it is straightforward to the dicarboxylate stage, after which side reactions occur. A mechanism is suggested. (auth)

**10901**

STERIC EFFECTS AND HYDROGEN ISOTOPE EXCHANGE IN 1,2,3-TRIMETHOXYBENZENE. D. P. N. Satchell (Brookhaven National Lab., Upton, N. Y.) J. Chem. Soc. 463-6(1959) Jan.

The hydrogen isotope exchange of 1,2,3-trimethoxybenzene was examined in sulfuric acid. The results, which are lower than the expected rate, are tabulated. It was concluded that direct steric shielding of the reaction centers is more important than any sterically induced loss of mesmomerism. The rate of tritium exchange of the 4 and 6 position of 2-hydroxy-1,3-dimethoxybenzene was also measured in aqueous sulfuric acid. These data are also included in the table. (J.R.D.)

**10902**

RARE-EARTH CARBIDES. PART I. R. C. Vickery, R. Sedlacek, and Ardys Ruben (Horizons, Inc., Cleveland). J. Chem. Soc., 493-503(1959) Feb.

Higher carbides of some rare earths have been prepared by reaction of rare-earth oxides and carbon at high temperatures under low pressures of argon. Formation of carbide proceeds via the metal, and interstitial compounds can exist of rare-earth metal held in the carbide lattice. The higher carbides (LnC$_2$) adopt a tetragonal structure, but scandium differs from the lanthanons and yttrium in forming only a hexagonal monocarbide (ScC); this is attributed to the small size of the scandium ion which permits its association with only one carbon atom. (auth)

**10903**

RARE-EARTH CARBIDES. PART II. MAGNETOCHEMISTRY. R. C. Vickery, R. Sedlacek, and Ardys Ruben (Horizons, Inc., Cleveland). J. Chem. Soc., 503-5(1959) Feb.

The intrinsic paramagnetism of tervalent rare-earth ions is affected only slightly by carbide formation. Except for samarium and ytterbium dicarbides, the small negative difference noted between the theoretical and the observed magnetism is attributed to partial spin coupling or quenching of the orbital angular moments. As carbides, samarium and ytterbium are considered to adopt their bivalent states. Bohr magneton numbers and Curie-Weiss constants are presented. (auth)

**10904**

RARE-EARTH CARBIDES. PART III. X-RAY ABSORPTION. R. C. Vickery, R. Sedlacek, and Ardys Ruben (Horizons, Inc., Cleveland). J. Chem. Soc., 505-10(1959) Feb.

K-edge absorption of some rare-earth carbides has been studied in further attempts to rationalize the structure of these compounds. The attainment of bivalent states in samarium and ytterbium carbides receives further confirmation, and from consideration of energy values the "free electron" concept appears substantiated. (auth)

**10905**

SOME ASPECTS OF THE ANION EXCHANGE BEHAVIOR OF URANYL NITRATE IN THE PRESENCE OF OTHER INORGANIC NITRATES. J. K. Foreman, I. R. McGowan, and T. D. Smith (United Kingdom Atomic Energy Authority, Seascale, Cumb., Eng. and Royal Coll. of Science and Tech., Glasgow). J. Chem. Soc., 738-42 (1959) Feb.

The addition of inorganic nitrates to aqueous solutions of uranyl nitrate enhances the uptake of uranium on the anion-exchange resin Deacidite FF in the order aluminum > calcium > lithium > ammonium. The predominating cause is considered to be the facilitation of formation of nitrate complexes by the uranyl ion, and of the subsequent ion-exchange, due to the decrease in the effective water content of the system resulting from hydration of the added cation. Visible absorption spectra revealed no new peaks ascribable to an anionic uranyl nitrate complex. (auth)

**10906**

EXPLOSIVE DECOMPOSITION AND ATOMIC FLAMES OF NORMAL AND HEAVY HYDRAZOIC ACID. THE TRANSITION $^3\Pi-^3\Sigma$ OF NH AND ND. Guy Pannetier and Henri Guenebaut (Faculté des Sciences, Paris). J. chim. phys. 56, 129-39(1959) Jan. (In French)

A general study of the emission spectra obtained from explosive decomposition phenomena and from the reaction of $N_3H$ and $N_3D$ with atomic hydrogen is presented. The bands (1.0), (2.1), (2.2), (1.2), and (0.1) of the electronic transition $^3\Pi-^3\Sigma$ of the NH and ND radicals, as well as the (3.2) band of ND appearing in the same reaction, were identified. The vibration analysis was made and confirmed by comparison of the experimental value of the isotopic displacement constant $\rho$ with the theoretical value. The dissociation energy of the NH and ND radicals were deduced by the Birge-Sponer linear extrapolation, the evolution of the $^3\Pi$ excited state to the $N(^2D)$ state of atomic nitrogen in the vicinity of the dissociation energy, and the energy separation of the $^1\Delta$ and $^3\Sigma$ electron states of ND. Finally, in the $N_3D/H$ reaction, the ratio $I_{ND}/I_{NH}$ takes a very high value for the triplet system, but it is very low for the singular system. In the hypothesis of a thermal decomposition of the $N_3D$ molecule, appearing directly during the reaction, this phenomenon can be explained by the law of conservation of spin if the $N_3H$ molecule has a triplet ground state. (tr-auth)

**10907**

MECHANISMS OF EXCHANGE AND SUBSTITUTION REACTIONS IN PLATINUM(IV) COMPLEXES. Fred Basolo, Aubrey F. Messing, Phillip H. Wilks, Ralph C. Wilkins, and Ralph G. Pearson (Northwestern Univ., Evanston, Ill.). J. Inorg. & Nuclear Chem. 8, 203-8 (1958).

Preliminary investigations on some reactions of platinum(IV) complexes are reported. Substitution and exchange reactions of platinum(IV) complexes were observed to be accelerated both by light and by platinum(II). Catalysis by $Pt(en)_2^{+2}$ of the extremely slow exchange of chloride ion with trans-$Pt(en)_2Cl_2^{+2}$ is believed to take place via a chloronium ion transfer through a bridged intermediate. The base hydrolysis of trans-$Pt(en)_2Cl_2^{+2}$ is independent of hydroxide ion concentration which suggests that the reaction proceeds by the dissociation of the conjugate base. Finally what may be the first example of a direct displacement ($S_N2$) reaction of an octahedral complex in water solution was observed for the reaction of trans-$Pt(en)_2Cl_2^{+2}$ with $NO_2^-$. (auth)

**10908**

SOME WATER-SOLUBLE COMPLEXES OF PENTAVALENT NIOBIUM AND TANTALUM. Fred Fairbrother, Derek Robinson, and John B. Taylor (Manchester Univ., Eng.). J. Inorg. & Nuclear Chem. 8, 296-301(1958).

It has been known for a long time that the hydrated oxides will dissolve in aqueous solutions of oxalic, tartaric, and citric acids and in alkaline solutions of catechol and pyrogallol. It has been shown that water-soluble complexes can be formed with a variety of $\alpha$-hydroxy acids, which may be phenolic or carboxylic, and with a number of amines. Complex formation with hydroxy compounds occurs through a condensation mechanism, akin to the flocculation or aging of the hydroxides, in which small units are attached to the complexing agent by elimination of water. Amine complex formation appears to occur through co-ordination by a usual type of donor-acceptor mechanism and is affected by steric considerations and may be correlated with the basic dissociation constant of the amine. One outstanding feature of the dissolution in solutions of these complexing agents is the much greater solubility of pure niobic acid as compared with pure tantalic acid. When the two oxides are co-precipitated however, part of the tantalum may be carried into solution with the niobium. This is a consequence of the polynuclear character of the complexes. (auth)

**10909**

NUCLEAR MAGNETIC RESONANCE STUDIES OF COORDINATE COMPLEX FORMATION BY BORON TRIFLUORIDE. Richard A. Ogg, Jr. (Stanford Univ., Calif.) and Peter Diehl (Univ. of Basel). J. Inorg. & Nuclear Chem. 8, 468-75(1958).

The physical chemistry of coordinate complex formation between boron trifluoride and suitable electron donor substances is readily accessible by the technique of igh resolution nuclear magnetic resonance spectroscopy. Fluorine magnetic resonance is studied in a liquid mixtures of boron trifluoride with two or more donor substances, the latter in stoichiometric excess. At sufficiently low temperatures separated narrow fluorine resonance lines are observed, corresponding to the respective boron trifluoride complexes involved in the various equilibria. The relative line intensities provide an index of the concentrations, and hence enable measurement of the equilibrium constants. In general these constants are the ratios of instability constants. The studies thus provide an arrangement of donor substances in a general basicity or "boron trifluoride affinity" series. The examples presented comprise principally oxygen compounds—water, acids, alcohols, ethers, esters, ketones, etc. Kinetic studies are allowed by the fact that at sufficiently high temperatures the fluorine resonance lines broaden and ultimately merge to a single narrow line—the latter phenomenon corresponding to a very rapid exchange of boron trifluoride between the various coordination complexes. Systematic studies furnish the qualitative aspects of the reaction mechanism and quantitative evaluation of rate constants. (auth)

**10910**

THE BISMUTH—BISMUTH TRICHLORIDE SYSTEM. S. J. Yosim, A. J. Darnell, W. G. Gehman, and S. W. Mayer (Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.). J. Phys. Chem. 63, 230-3(1959) Feb.

A phase equilibrium study of the bismuth—bismuth trichloride system has been carried out. The experimental techniques included sampling at temperature, thermal analysis, and visual observations. The miscibility gap was found to be closed at a consolute temperature of 780° and 51 mole % Bi. In the two liquid phase region, the solubility of the salt in the metal increased with increasing temperature while the solubility of bismuth in bismuth trichloride decreased from 45% at 320° to 28% at about 550°. Results in the liquid-solid region are reported and compared with those of earlier workers. (auth)

**10911**

SEPARATION OF METAL IONS BY MEANS OF ION EXCHANGE MEMBRANES. I. SEPARATION OF RARE EARTH MIXTURES, AND OF THORIUM-RARE EARTH MIXTURES USING ETHYLENEDIAMINETETRAACETIC ACID. K. Bril, S. Bril, and P. Krumholz (Research Lab. of Orquima S. A., São Paulo, Brazil). J. Phys. Chem. 63, 256-9(1959) Feb.

A method of separation of metal ions by electromigration in partially complexed solutions is described. The method makes use of ion-exchange membranes. Ethylenediaminetetraacetic acid is used as the complexing agent. Good separations are obtained in mixtures of lanthanum, praseodymium, and neodymium as well as of thorium and neodymium. The separation is affected by the nature of the accompanying anions. The influence of perchlorate, chloride, nitrate, and acetate is studied. (auth)

**10912**

THE VAPOR PRESSURES OF $BiI_3$ OVER LIQUID $Bi-BiI_3$ SOLUTIONS. Daniel Cubicciotti and F. J. Keneshea, Jr. (Stanford Research Inst., Menlo Park, Calif.). J. Phys. Chem. 63, 295-7(1959) Feb.

The vapor pressures of $BiI_3$ over the liquid and its mixtures with Bi were determined from 410 to 470°C and over the composition range 0 to 50 mole % Bi. The vapor pressure of $BiI_3$ could be expressed by the equation $\log p(\mathrm{mm}) = -4310/T + 8.170$. The activity of the $BiI_3$ followed Raoult's law up to about 30 mole % added Bi and showed positive deviations for larger Bi concentrations. (auth)

**10913**

DETERMINATION OF URANIUM IN URANIUM ORES AND INDUSTRIAL PRODUCTS BY COMBINED ION EXCHANGE AND COMPLEXOMETRIC METHODS. Miklos Fodor (Academy of Sciences of Hungary). Magyar Tudományos Akad. Központi Fiz. Kutató Intézeténck Közlemenyei 5, 445-57(1957). (Translated from Referat. Zhur. Khim. No. 18, 1958, Abstract No. 60618.)

A simple and rapid method was developed for separating U from admixtures, which pass into solution together with U, when it is separated from ores, and which interfere with its determination. Ethylenedinitrilotetraacetic acid (I) is added (in a 1.5-fold excess with reference to the expected concentration of the salt) to the solution to be analyzed. At this occasion, the admixtures produce strong anion complexes with I, while U produces a very unstable complex with I under these conditions (pH about 7). The solution is diluted with water and let through a column (1 cm in diam, length 10 cm) at the rate of 3 ml per min. The column contains cation-exchange resin Amberlite IRC-50 in the H form (in order to convert the resin into the H form, it is treated preliminarily with 50 ml of 3 M $H_2SO_4$). At this occasion, the interfering elements pass into the filtrate in the form of complexes, and U remains in the column. After that U is eluted from the column with 3 M $H_2SO_4$ solution, reduced to $U^{4+}$ by passing the obtained solution immediately through Bi and Cd reducer $U^{3+}$ forming in a small quantitiy is oxidized to $U^{4+}$ by passing air through the solution), and titrated with 0.005 n. ammonium vanadate solution (indicator—phenylanthranylic acid) or with 0.005 n. $Ce(SO_4)_4$ solution (indicator—ferroin). A complete separation takes about 3 hours; one chemist can carry out 10 separations simultaneously. The following was studied: the optimum conditions of U reduction and titration, the completeness of the binding of $U^{6+}$ and $U^{4+}$ to the resin in the presence of I (the binding is quantitative for both ions), and the completeness of U separation from ore of a known composition in cases, when the ore dissolution has been carried out with sulfuric acid or soda in the presence of oxidizers. It was found that the described method is justified in all cases and sufficiently accurate (error about 1%).

**10914**

BETA-POLYMORPHS OF URANIUM AND THORIUM DISILICIDES. A. Brown and J. J. Norreys (General Electric Co., Ltd., Wembley, Middlesex, Eng.). Nature 183, 673(1959) Mar. 7.

Beta phases of uranium and thorium disilicides were prepared by arc melting and examined by metallographic and x-ray-diffraction techniques. A noticeable feature of the preparations is the formation of $\beta$-$USi_2$ and $\beta$-$ThSi_2$ form mixtures containing 62 to 63 at. % silicon, compared with the 66.7 at. % required for the formation of the alpha disilicides. The compositions of these so-called beta phases accordingly appear to be $U_3Si_5$ and $Th_3Si_3$. Values for the structural dimensions of these two phases are as follows: $U_3Si_5$: $a_0 = 3.843 \pm 0.001A$; $c_0 = 4.069 \pm 0.001A$. $Th_3Si_5$: $a_0 = 3.985 \pm 0.001A$; $c_0 = 4.228 \pm 0.001A$. During an investigation into reactions between the silicides of uranium and thorium and liquid bismuth, two new silicide phases were isolated.

X-ray analysis shows that they are hexagonal with space group $C_6$/mmm. These new phases, like the above compounds, have the Al$\beta_2$-type crystal structure, but the cell dimensions are different and, in particular, the axial ratio $c/a < 1$ compared with $c/a > 1$ for the $U_3Si_5$ and $Th_3Si_5$ compounds. Heat treatment of the new thorium–silicon compound in the temperature range 1000 to 1200°C transforms it into $\alpha$-$ThSi_2$, while heat treatment of $\alpha$-$ThSi_2$ at 850°C yields the new thorium–silicon phase. It is clear that this compound is in fact the true $\beta$-$ThSi_2$ and the analogous uranium compound the true $\beta$-$USi_2$. The structure cell dimensions obtained from x-ray-diffraction results are: $\beta$-$USi_2$: $a_0 = 4.028 \pm 0.001$A.; $c_0 = 3.852 \pm 0.001$A. $\beta$-$ThSi_2$: $a_0 = 4.136 \pm 0.001$A.; $c_0 = 4.126 \pm 0.001$A. (auth)

**10915**

SEPARATION OF STRONTIUM-90 FROM CALCIUM. P. S. Davis (Australian Atomic Energy Commission, New South Wales). Nature 183, 674-5(1959) Mar. 7.

A study was made of the absorption of calcium and strontium by a cation exchange resin, "Zeo-Karb 225," in the presence of ethylenediaminetetraacetic acid over the pH range 3 to 7. Results indicate that at pH 5.25, strontium, present in cationic form, is quantitatively retained on the resin, while calcium is complexed by the ethylenediaminetetraacetic acid and passes through. This ion-exchange recovery of strontium from strontium–calcium mixtures is achieved with use of very small columns and should be capable of application to the simple determination of strontium-90 on a routine basis, considerably reducing the time required for each determination. (J.H.M.)

**10916**

ZETA POTENTIALS OF $ThO_2$ AND OF STAINLESS STEEL AS RELATED TO AGGREGATION AND CAKING. B. Levy and A. R. Fritsch (Westinghouse Electric Corp., East Pittsburgh, Penna.). Nuclear Sci. and Eng. 5, 143-9(1959) Mar.

The streaming potential technique was used to obtain the zeta potentials of $ThO_2$ in HCl, HI, $HNO_3$, $H_2SO_4$ of various concentrations. The data are correlated with observed settling rates and tendency toward $ThO_2$ colloid formation. Streaming current measurements were made on type 304 stainless steel samples. Evidence is presented to demonstrate the significance of the zeta potentials of the $ThO_2$ and the stainless steel in the formation of thin films and thick cakes of $ThO_2$ on the stainless steel. (auth)

**10917**

GAMMA SPECTROMETRIC ASSAY OF FISSION-PRODUCT $Kr^{85}$. H. W. Alter (General Electric Co., Pleasanton, Calif.). Nucleonics 17, No. 4, 124(1959) Apr.

Gamma spectrometry for $Kr^{85}$ assay of short-cooled fuel samples is described and discussed. This method is better than the beta counting method, the $Kr^{85}$ 0.52-Mev gamma being higher than other noble gas nuclides. A spectrometer setup and its calibration are described. (T.R.H.)

**10918**

PREPARATION OF ORTHO AND PARA MODIFICATIONS OF DEUTERIUM MIXTURES. V. T. Smolyankin and A. I. Shal'hikov. Pribory i Tekh. Ekspt. No. 1, 150(1959) Jan.-Feb. (In Russian)

A method is suggested for preparing gaseous mixtures of ortho and para modifications of deuterium at pressures close to atmospheric. (R.V.J.)

**10919**

CHLORINATION OF ZIRCONIUM DIOXIDE BY GASEOUS CHLORINE IN THE PRESENCE OF SOLID CARBON. B. D. Vasilenko and A. N. Vol'skii. Sbornik Nauch. Trudov Moskov. Inst. Tsvetnoĭ Met. i Zolota No. 27, 119-35(1957). (Translated from Referat. Zhur. Met. No. 8, 1958, p. 70.)

A study is made of the relationship between the rate of chlorination of briquets of a mixture of $ZrO_2$ and soot on the one hand and a series of factors and the composition of the gas phase in chlorination on the other. It is established that in this process the C may oxidize to $CO_2$ or to CO, the latter of which acts to reduce the $ZrO_2$. The rate of chlorination in the presence of CO is almost fifty per cent less than with solid C at the same $Cl_2$ consumption. When the briquets are chlorinated with solid C, the $CO/CO_2$ ratio in the gas phase rises with increasing temperature, attaining a value of 5 at 1000°C and a $ZrO_2$:C molecular ratio of 1:2. Three regions of dependence of chlorination rate upon temperature are noted: A kinetic interval up to 520°, an intermediate from 520 to 700°, and a diffusive at >700°. Mathematical expressions for the relationship between the chlorination rate and the partial pressure of the $Cl_2$ and the rate of flow of the $Cl_2$ are presented. The temperature of the chlorination process is 700°.

**10920**

CERIMETRIC DETERMINATION OF URANIUM$^{IV}$. USE OF TRIPHENYLMETHANE DYES AS INTERNAL INDICATORS. V. Panduranga Rao and G. Gopala Rao (Andhra Univ., Waltair, India). Talanta 1, 355-8 (1958) Nov.

The use of the triphenylmethane dyes (erioglaucine, eriogreen, and xylene cynol FF) as internal indicators in the cerimetric titration of $U^{4+}$ has been investigated. The titration is possible in the cold with sufficient rapidity and accuracy, the indicator color change appearing sharply at the equivalence point. The indicator reactions are rapid and reversible within a wide range of acidity, from 0.5 to 8.0N, unlike other indicators, e.g. diphenylbenzidine, N-phenylanthranilic acid, or ferroin, which require specified conditions for their proper functioning. These indicators can also be used for titration of $U^{4+}$ with ceric ammonium nitrate in perchloric acid medium (but not in nitric acid medium). (auth)

**10921**

AN ACCELERATED METHOD OF INSPECTION OF METALLIC POTASSIUM FOR POTASSIUM AND SODIUM CONTENT. E. S. Bannykh and A. P. Sachko. Trudy Ural. Nauch. Issledovatel. Khim. Inst. No. 4, 209-17 (1957). (Translated from Referat. Zhur. Met. No. 4, 1958, p. 334.)

A method is suggested for the determination of Na in metallic K by means of the solidification temperature (ST) of the fused metal and its total alkalinity (TA). About 2 to 2.5 g is taken from a moderate sample of K and placed in a special device filled with N. The sample is dissolved in 96% alcohol and an aliquot portion is titrated with 0.25N HCl, thus determining the TA of the sample. To determine the ST, pieces of M are placed in a glass test tube 28-30 mm in diam and 18-20 cm long, which is lowered into a vaseline bath heated to ~100°C. The sample is heated to 75-80° and, after the bath is removed, the ST of the M is read three times with a mercury thermometer.

**10922**

ON THE POLYMORPHISM OF CALCIUM CARBIDE. M. A. Bredig (Oak Ridge National Lab., Tenn.). Z. anorg. u. allgem. Chem. 298, 255-7(1959) Jan.

A brief review of the literature is given. It is demonstrated that a recent suggestion regarding the alleged existence of a fifth crystal modification of calcium carbide was based on an erroneous interpretation of an x-ray pattern. Doubt is also expressed as to a suggested molar volume for cuprous acetylide. (auth)

**10923**

THE SPECTROPHOTOMETRIC DETERMINATION OF CERIUM IN PREPARATIONS OF LANTHANUM, NEODYMIUM AND PRASEODYMIUM. B. M. Dobkina and T. M. Malyutina. Zavodskaya Lab. 24, 390-2(1958).

On the basis of the method developed by Telep and Boltz a method of determining Ce in La, Nb, and Pr was worked out with a sensitivity of up to 5 to 10 $\gamma$ Ce/25ml. Among other things it was found that the optical density of cerium concentration is of rectilinear character and that deviations do not exceed 2 to 3%. (TCO-W.D.M.)

**10924**

SPECTRAL ANALYSIS ACCORDING TO THE VAPORIZATION METHOD. SURVEY. L. V. Lipis. Zavodskaya Lab. 24, 736-45(1958).

The method of analysis by fractionation vaporization is described in detail. For experiments carried out by vaporization in a vacuum comparative results are given in the form of a table together with data concerning the application of various spectrographs. Data for various elements and their compounds are given. (TCO-W.D.M.)

**10925**

CO-PRECIPITATION IN QUANTITATIVE ANALYSIS. COMMUNICATION V. THE INFLUENCE EXERCISED BY COMPLEXON UPON THE PRECIPITATION OF ZIRCONIUM PHOSPHATE. A. K. Babko and M. I. Shtokalo. Zavodskaya Lab. 24, 674-7(1958).

The influence exercised by ethylenediamino-tetraacetic acid upon some processes of precipitation was investigated. A sharp modification of the form of precipitate as well as a decrease of coprecipitation was observed. Data concerning the separation of zirconium and titanium by means of the phosphate method are given. (TCO-W.D.M.)

**10926**

SPECTROPHOTOMETRIC DETERMINATION OF NIOBIUM IN ALLOYS. I. P. Kharlamov, P. Ya. Yakovlev, and M. I. Lykova (Central Scientific Inst. of Ferrous Metallurgy). Zavodskaya Lab. 24, 128-32(1958). (In Russian)

A spectrophotometric determination of niobium in silicon, tungsten, molybdenum, and titanium was carried out with chemically pure niobium pentoxide and a SF-4 spectrometer with a hydrogen tube. The tabulated results are in good agreement with results obtained by other methods. (R.V.J.)

**10927**

RADIOMETRIC DETERMINATION OF URANIUM, THORIUM, AND RADIUM IN ORES. E. I. Zheleznova and D. V. Tokareva (All-Union Inst. of Mineral Raw Materials). Zavodskaya Lab. 24, 959-63(1958). (In Russian)

A radiometric determination of uranium with various radioactive contaminants based on the principle of the $\gamma$ radiation threshold is described. Measurements are made of the total $\gamma$ radiation and the intensity of the strong portion of the spectrum (which is predominately emanated by thorium). Experiments with 100 specimens showed a satisfactory quantitative determination of uranium, thorium, and radium in any radioactive ore with radiometer analyzers with scintillation or gas-filled counters. (R.V.J.)

**10928**

DETERMINATION OF HYDROGEN IN TANTALUM, NIOBIUM, AND URANIUM. A. N. Zaidel and K. I. Petrov. Zavodskaya Lab. 24, 1000-1(1958). (In Russian)

A method of isotopic equilibrium was used for determining the content of hydrogen in tantalum, niobium, and uranium. The relation between hydrogen and deuterium content in the gas phase and time and heating temperature indicated the optimum conditions for niobium and tantalum at 800°C for 15 min and for uranium at 1000°C and 30 min. Results of the isotopic composition in the gas phase for the investigated metals are tabulated. The sensitivity of hydrogen determination in specimens up to 1 g is $1 \times 10^{-4}$ wt.%; the mean quadratic error is ±8 to 10%. (R.V.J.)

**10929**

DETERMINATION OF RARE EARTHS BY ARSENAZO. A. F. Kuteinikov (All-Union Inst. of Mineral Raw Materials). Zavodskaya Lab. 24, 1050-2(1958). (In Russian)

Physico-chemical analyses were made of complex solutions of arsenazo with various elements (Al, Be, Co, Cu, Fe(III), Ga, In, Ni, Sc, Th, Ti(IV), U(IV), U(VI), Y, Zr.). The optimum colors were developed with the isomolar series. Alternating cation concentration with constant reagent was used for the rare metals. The properties and conditions of complex formation of metals with arsenazo reagent are tabulated. (R.V.J.)

**10930**

NIOBIUM AND ZIRCONIUM SEPARATION BY SELENIOUS ACID. I. P. Alimarin and E. I. Stepanyuk (Lomonosov Inst. of Fine Chemical Tech.). Zavodskaya Lab. 24, 1065-6(1958). (In Russian)

Separation of niobium from zirconium by selenious acid precipitation showed satisfactory results. However, a certain loss of niobium was observed with large zirconium contents. A spectral analysis of the niobium pentoxide precipitations showed the presence of less than 0.05% zirconium. (R.V.J.)

**10931**

A DIRECT MASS SPECTROMETRIC DETERMINATION OF DEUTERIUM CONTENT IN DEUTEROBENZOLE. G. A. Semenov and M. Ya. Turkina (State Inst. of Applied Chemistry). Zavodskaya Lab. 24, 1084-6 (1958). (In Russian)

Low-voltage mass spectroscopy was used for analyzing mixed molecules with different degrees of deuterization. The main disadvantages of the method were due to the low ionic current which is difficult to record. In some cases the potential of the first fragment appearance is close to the molecule ionization potential, making the appearance of ion fragments unavoidable. The benzole ionization potential and potential of the first ion fragment appearance are tabulated. The results of the analysis were verified with ionization voltages of 12 to 16 v. In 2-hr measurements, no changes were observed in the spectrum, indicating the absence of deuterium exchange with hydrogen of the water. (R.V.J.)

**10932**

DETERMINATION OF THORIUM AND URANIUM IN SANDS BY ACID LEACHING. V. I. Kuznetsov, G. I.

Malofeeva, and I. V. Nikol'skaya (Vernadskii Inst. of Geochemistry and Analytical Chemistry, Academy of Sciences, U.S.S.R.). Zavodskaya Lab. 24, 1178-9(1958). (In Russian)

Descriptions are given of thorium and uranium determinations by acid leaching of silicates with hydrochloric acid. (R.V.J.)

**10933**

COLOR REACTIONS OF URANIUM AND THORIUM WITH 2-ARSENAZO-2'-HYDROXY-AZO COMPOUNDS. V. I. Kuznetsov (Vernadsky Inst. of Geochemistry and Analytical Chemistry, Moscow). Zhur. Anal. Khim. 14, 7-16(1959) Jan.-Feb. (In Russian)

**10934**

STUDY OF THE ANALYTICAL CHEMISTRY OF THALLIUM. COMMUNICATION 2. THE PRECIPITATION OF TRIVALENT THALLIUM BROMIDE COMPLEXES WITH SOME PYRAZOLONE DERIVATIVES. A. I. Busev and V. G. Tiptsova (Lomonosov Moscow State Univ.). Zhur. Anal. Khim. 14, 28-36(1959) Jan.-Feb.

Trivalent thallium ion can be precipitated in the presence of bromine ions with pyramidon, antipyrine, diantipyriylmethane, and diantipyriylphenylmethane with the formation of compounds corresponding to the formulas: $C_{13}H_{17}ON_3 \cdot HTlBr_4$, $(C_{11}H_{12}ON_2)_2 \cdot HTlBr_4$, $C_{23}H_{24}O_2N_4 \cdot HTlBr_4$, $(C_{11}H_{11}ON_2)_2CHC_6H_5 \cdot HTlBr_4$. Some properties of these compounds were studied. It was shown that $C_{13}H_{17}ON_3 \cdot HTlBr_4$, $(C_{11}H_{12}ON_2)_2 \cdot HTlBr_4$, $C_{29}H_{28}O_2N_4 \cdot HTlBr_4$ are useless for the determination of thallium while $C_{23}H_{24}O_2N_4 \cdot HTlBr_4$ permits the development of a gravimetric and amperometric method for determining thallium in the presence of other elements (Cu, Zn, Cd, Bi, Fe, Sb). (auth)

**10935**

INCREASE OF SENSITIVITY AND ACCURACY OF THE DETERMINATION OF CESIUM IN MINERALS BY FLAME PHOTOMETRY. E. A. Fabrikova (Inst. of Mineralogy, Geochemistry and Crystallochemistry of Rare Elements, Moscow). Zhur. Anal. Khim. 14, 41-4 (1959) Jan.-Feb. (In Russian)

A highly sensitive method was developed for determining cesium in minerals by flame photometry. The method is based on the effect of increased intensity of cesium radiation ($\lambda$ = 8521 A) when large quantities of potassium are introduced into the analyzed solution. (auth)

**10936**

PHOTOMETRIC DETERMINATION OF THE SUM OF RARE EARTHS IN ORES AND ROCKS. F. V. Zailovskii and V. S. Bashmakova (All-Union Inst. of Mineral Raw Materials, Moscow). Zhur. Anal. Khim. 14, 50-4(1959) Jan.-Feb. (In Russian)

It was found that Beer's law is obeyed by the solutions of cerium and yttrium rare earth complexes with arsenazo. The interference of calcium and other elements during photometering is eliminated with sulfosalycylic and tartaric acids. A method is suggested for separating small amounts of thorium from the sum of rare earths. A photometric method was developed for determining 0.01 to 3% of the sum of rare earths in ores and rocks with the experimental error of 20%. It is possible to carry out 8 to 10 analyses in the course of 8 to 10 hours. (auth)

**10937**

GRAVIMETRIC AND PHOTOMETRIC DETERMINATION OF THORIUM CONCENTRATION IN URANINITES BY MEANS OF ANTHRANILIC ACID. Yu. V. Morachevskii and I. A. Tserkovnitskaya (Zhdanov Leningrad State Univ.). Zhur. Anal. Khim. 14, 55-9(1959) Jan.-Feb. (In Russian)

The possibility was studied for isolating thorium in the presence of uranium, rare earths, and lead by means of anthranilic acid. It is shown that thorium can be quantitatively precipitated at a concentration not less than 0.2 mg/50 ml. A photometric method for determining thorium is suggested based on the formation of a colored compound owing to the reaction between anthranilic acid, nitrous acid, and $\beta$-naphthol. The method is highly sensitive and permits the determination up to 0.04 $\mu$g of Th/ml. The method of the isolation and determination of thorium was applied to the analysis of natural uraninites and gave satisfactory results. (auth)

**10938**

POLAROGRAPHIC CHARACTERISTICS OF NIOBIUM IN PHOSPHORIC ACID SOLUTIONS. D. I. Kurbatov (Ural Branch of the Academy of Sciences, Sverdlovsk U.S.S.R.). Zhur. Anal. Khim. 14, 63-6(1959) Jan.-Feb. (In Russian)

A polarographic study of phosphoric acid—niobium solutions was carried out. It was found that niobium gives a well developed wave in concentrated phosphoric acid (1.75). The limiting current value has a linear relationship to the niobium concentration in solutions from 0.5 to 50 mM/l. Niobium solutions in phosphoric acid are stable, and the reproducibility of polarograms is good. The half-wave potential increases from 0.6004 to 0.680 v (S.C.E.) with the increase of the niobium concentration (from 0.5 to 50 mM/l). The reduction of Nb(V) in a phosphoric acid solution is irreversible. (auth)

**10939**

DETERMINATION OF NIOBIUM IN THE PRESENCE OF TUNGSTEN BY MEANS OF CUPFERRON. A. I. Ponomarev and A. Ya. Sheskolskaya. Zhur. Anal. Khim. 14, 67-70(1959) Jan.-Feb.

A rapid and accurate method is suggested for determining niobium in the presence of large quantities of tungsten. Unlike other methods, this method is highly accurate and does not require the preliminary separation of the above mentioned elements. The method is based on the niobium precipitation with cupferron in a weakly hydrochloric acid medium in the presence of oxalic acid forming a complex compound with tungsten. (auth)

**10940**

AMPEROMETRIC TITRATION OF IRIDIUM BY MEANS OF A ROTATING PLATINUM ELECTRODE. N. K. Pshenitsyn and N. A. Ezerskaya (Inst. of General and Inorganic Chemistry, Moscow). Zhur. Anal. Khim. 14, 81-6(1959) Jan.-Feb. (In Russian)

Amperometric titration of small amounts of Ir(IV) ($10^{-5}$ to $10^{-3}$ M) with hydroquinone and ascorbic acid in the presence of Rh, Pt, Pd, Cu, Ni, Pb, Se, and Te is shown to be possible. Conditions were found for titrating iridium in the presence of Ru(IV) and Fe(III). (auth)

**10941**

CHEMICO-SPECTROGRAPHIC METHOD FOR THE ANALYSIS OF METALLIC BERYLLIUM AND BERYLLIUM OXIDE OF HIGH PURITY. A. G. Karabash, Sh. I. Peizulaev, R. L. Slyusareva, and V. M. Lipatova. Zhur. Anal. Khim. 14, 94-9(1959) Jan.-Feb. (In Russian)

A chemico-spectrographic method was developed for determining 24 element admixtures in beryllium and beryllium oxide. To concentrate admixtures (20 to 25 times), beryllium is separated as base acetate by extracting with chloroform. The sensitivity of the determination increases up to $10^{-4}$ to $10^{-5}$%. The method can be used for the analytical control of the production of high purity materials. A method was developed for the spectrographic analysis of samples without concentrating admixtures. The method can be used for the analytical control of commercial products with sensitivity $10^{-3}$ to $10^{-4}$%. (auth)

**10942**

SEMI-MICROMETHOD FOR ISOTOPIC ANALYSIS OF SUBSTANCES CONTAINING ABOUT 100% OF DEUTERIUM. A. I. Shatenshtein and Yu. I. Antonchik (Karpov Physico-Chemical Inst., Moscow). Zhur. Anal. Khim. 14, 100-3(1959) Jan.-Feb. (In Russian)

A semi-micromethod is described for the analysis of substances containing about 100% deuterium. To carry out the determination, it is necessary to obtain 0.2 to 0.3 ml of water when the substance is burned. The method is based on measuring water density with a micro-float. The accuracy of the method of 0.05%. The method is used for the analysis of organic compounds containing about 100% deuterium and deuterioammonia obtained by the interaction of $D_2O$ and $Mg_3N_2$. (auth)

**10943**

SPECTROGRAPHIC DETERMINATION OF BISMUTH, CADMIUM, TIN, LEAD AND ANTIMONY ADMIXTURES IN TANTALUM. E. I. Zakharov, L. V. Lipis, and K. I. Petrov. Zhur. Anal. Khim. 14, 135-6(1959) Jan.-Feb. (in Russian)

A method is described for determining Bi, Cd, Sn, Pb, and Sb ($1 \times 10^{-4}$%) in tantalum after converting it to tantalum oxide by the evaporation method. (auth)

**10944**

ON MASS-SPECTROMETRIC ANALYSIS OF THE ISOTOPE COMPOSITION OF BORON. G. A. Semenov and Yu. A. Zonov (Zhdanov Leningrad State Univ.). Zhur. Anal. Khim. 14, 137-8(1959) Jan.-Feb. (In Russian)

A method of evaporation from a band is used for the mass-spectrometric isotopic determination of boron in boron oxide and boric acid. The isotope composition of boron in boron oxide with natural and changed correlation of isotopes was measured. The results of the analysis was checked by the measurements with $BF_3$ as a working substance. (auth)

**10945**

MICRO-METHOD FOR DETERMINING FLUORINE MONOXIDE. E. A. Peregud and B. S. Boikina (State Scientific-Research Inst. of Work Hygiene and Occupational Diseases, Leningrad). Zhur. Anal. Khim. 14, 141-2(1959) Jan.-Feb. (In Russian)

The method is based on the displacement of bromine from potassium bromide and the formation of eosine. When $OF_2$ containing air is drawn through the indicator tube containing silica gel and fluoresceine, the original yellow color turns red. The length of the colored zone is proportional to the quantity of fluorine monoxide. Optimum conditions for the determination were established. (auth)

**10946**

DETERMINATION OF THALLIUM BY HIGH-FREQUENCY TITRATION WITH SODIUM TETRAPHENYLBORON. A. R. Veis and A. F. Yevins (Latvian State Univ., Riga). Zhur. Anal. Khim. 14, 143-4 (1959) Jan.-Feb. (In Russian)

A method was developed for the determination of thallium by high-frequency titration with $NaB(C_6H_5)_4$. Cations which do not react with $NaB(C_6H_5)_4$ do not interfere. The determination is possible in weakly acid as well as in alkaline medium. (auth)

**10947**

THE ELEMENTARY COMPOSITION OF NUCLEAR PHOTOGRAPHIC EMULSIONS. M. F. Radicheva. Zhur. Nauch. i Priklad. Fot. i Kinematografii 3, 286 (1958).

The method proposed by Swinnerton and Waller was used to determine the content of the elements in 17 batches of backless type R emulsion films from NIKFI. The carbon and hydrogen content were found by the microanalytic method and the nitrogen content by a combination of Dumas' microanalytical method with the macromethod of Kieldale. The results are set out in tabular form. (TCO)

**10948**

A STUDY OF THE RADIOLYSIS OF SILVER HALIDE. K. S. Bogomolov and I. F. Razorenova. Zhur. Nauch. i Priklad. Fot. i Kinematografii 3, 321-2(1958).

Tests were made to determine the loss of energy by the ionizing particles in the radiolysis of silver halide. The effects of grain size, degree of maturation, and gold sensitization were studied. Emulsions were exposed to electrons with an energy of 61 kev, and the photographic silver was determined by potentiometric titration. The results show that the loss of energy through electron action in the formation of one atom of silver depends on the maturation period of the emulsion and is not affected essentially by gold sensitization. When the emulsion is affected by light this dependence does not hold. It is concluded that the energy quantum of light is entirely absorbed by the emulsion. Secondary electrons, on the other hand, move in the emulsion structure and help to raise its thermal energy. In emulsions with very low maturation periods, not all the electrons are captured by the sensitivity centers, and part of their energy goes to build up the semi-crystalline particles, thus completing the emulsion's structure. (auth)

**10949**

THE SENSITIVITY OF HYPERSENSITIZED NUCLEAR PHOTOGRAPHIC EMULSIONS AT THE TEMPERATURE OF LIQUID HYDROGEN. K. S. Bogomolov, I. F. Razorenova, I. A. Ruditskaya, A. A. Sirotinskaya. Zhur. Nauch. i Priklad. Fot. i Kinematografii 3, 380-1 (1958).

Backingless "P" films with iodide, and others without iodide, sensitized in a 3% solution of triethanolamine, were exposed in liquid hydrogen to gamma radiation at 250 Mev or to a beam of $\pi$ mesons at 300 Mev. The results are drawn up in tabular form. The trajectories of the relativistic particles can be traced in the form of very dense tracks on the hypersensitized, iodine-less silver bromide nuclear emulsions. A significant drop in the sensitivity of the emulsions containing iodide at liquid hydrogen temperature can be confirmed from the table. (auth)

**10950**

COLORIMETRIC DETERMINATION OF TRACES OF METALS. Third Edition, Revised and Enlarged. E. B. Sandell. New York, Interscience Publishers, Inc., 1959. 1052p.

Part one of this volume discusses the general aspects of inorganic colorimetric trace analysis in detail. Part two is devoted to a very detailed description of procedures for the determination of a large number of metals. (W.L.H.)

## Radiation and Radiochemistry

**10951** AECU-4057
University of Notre Dame, Notre Dame, Ind.
SUMMARY OF PROCEEDINGS OF AN INFORMAL DISCUSSION ON THE RADIATION CHEMISTRY OF WATER, JANUARY 8-9, 1959. G. von Bünau, K. C. Kurien, W. H. Taylor, and L. M. Theard, eds. 46p. Radiation Project. Contract AT(11-1)-38. $7.80(ph), $3.30(mf) OTS.

A report of discussions on radiation chemistry prepared from the editor's notes is presented. Included are sections on the present state of radiation chemistry of water, recent developments in theory, radiolysis of water in the solid state, electron capture and negative ion formation, new experimental techniques, and cube root law. (J.R.D.)

**10952** AEC-tr-3634
IDENTIFICATION OF URANIUM FISSION PRODUCTS THROUGH PAPER CHROMATOGRAPHY. H. Götte and Doris Pätze. Translated by Margaret V. Colven (Savannah River Lab.) from Angew. Chem. 69, 608-14 (1957). 20p. $4.80(ph), $2.70(mf) JCL or LC.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 5243.

**10953** CEA-tr-R-279
CONCENTRATION DES ISOTOPES DE $^{13}$C ET $^{18}$O DANS L'OXYDE DE CARBONE PAR LA MÉTHODE DE DIFFUSION THERMIQUE. (Concentration of the Isotopes of $C^{13}$ and $O^{18}$ in Carbon Monoxide by the Method of Thermal Diffusion.) G. M. Pantchenko and V. D. Moïsseev. Translated into French from Zhur. Fiz. Khim. 30, 1662-7(1956). 14p.

A thermal diffusion apparatus is described which was used to study the concentration of $C^{13}$ and $O^{18}$ in CO gas. The experimental results compared with theoretical values so that the equipment performance can be predicted semi-quantitatively. A method and apparatus for oxidizing CO to $CO_2$ using $IO_5$ are also given. (T.R.H.)

**10954** CEA-tr-R-607
A PROPOS DE LA RÉTENTION PRIMAIRE DANS LE PROCESSUS DE SZILARD-CHALMERS. (Primary Retention in Szilard-Chalmers Processes.) C. Svoboda. Translated into French from Zhur. Neorg. Khim. 3, 187-94(1958). 21p.

Four types of retention in the Szilard-Chalmers process were studied in connection with the phenomena which they provoke. A formula which expresses the reciprocal relation between the individual retentions and the total retention was established. Formulas for the calculation of the primary retention in the case of emission of one, two, or three, or more gamma quanta were derived. The effect of the internal inelastic interactions on the increase of the primary retention was discussed. 37 references. (tr-auth)

**10955** IGRL-T/R-80
THE STATE OF MICRO-QUANTITIES OF RADIOELEMENTS IN SOLUTION. I. E. Starik, K. A. Gavrilov, A. N. Ratner, and I. A. Skulskii (Skulsky). Translated by E. G. Peters (U.K.A.E.A., Risley) from Zhur. Neorg. Khim. 2, 1175-82(1957). 13p.

Zirconium-95 at a concentration of $10^{-11}$ mole in nitric acid solutions of up to 4.2 pH is in the form of positive ions. At a pH of 4.2 dissolution to $Zr(OH)_4$ begins, and a negatively charged colloid of zirconium hydroxide is formed. Under the conditions existing in the experiments, beginning with a pH of 1 to 1.6 and going up to 4.2, zirconium was significantly adsorbed onto negatively charged impurities fortuitously present in the solutions, and formed the so-called "radiocolloids." Experiments carried out show that zirconium adsorbed on impurities can be redistributed on to high-capacity adsorbents—filters, in this case. The retention of $Zr^{95}$ by paper filters during the filtration of microquantities of radioelements depends on adsorption. Adsorption experiments show that at a pH of less than 4.2 ion-exchange adsorption takes place, whereas at a pH of more than 4.2 zirconium is adsorbed in the form of colloidal particles. The study of the adsorption of radioelements by paper filters can give a clear indication of the state of microquantities of radioelements in solution only when taken in conjunction with other methods (desorption, ultrafiltration, electrophoresis, centrifuging, etc.). It has been shown that it is possible to separate $Zr^{95}$ from $Nb^{95}$ by the adsorption of the $Nb^{95}$ on to porous glass filters from 10 N $HNO_3$. (auth)

**10956**
CHEMICAL ANALYSIS BY NEUTRON ACTIVATION. Jacques Fouarge (Univ. of Michigan, Ann Arbor). Ind. chim. belge 24, 143-54(1959) Feb. (In French)

Analysis by activation with neutrons from an average power reactor ($10^{12}$ neutrons/cm$^2$/sec) is a very sensitive method for the majority of elements, to microgram quantities of $10^{-15}$ g. This method is safe from contamination by reagents during the course of chemical treatment after the irradiation. The gamma spectrometer is used for rapid qualitative analyses in the vicinity of the reactor. A table gives an idea of the limits of sensitivity which it is possible to obtain. After a brief review of applications already published, some new applications are suggested. 75 references. (tr-auth)

**10957**
IRRADIATION OF PETROLEUM HYDROCARBONS. COMPARATIVE EFFECTS OF PARTICLE SIZE. R. M. Lincoln, R. L. Rogers, H. Burwasser, and V. J. Keenan (Atlanta Refining Co., Philadelphia). Ind. Eng. Chem. 51, 547-8(1959) Apr.

Preceeding work by the authors has shown the radiolysis of paraffins to yield mainly olefin and dimer. Current effort involves the effect of particle types on the hydrocarbons cyclohexane, methylcyclohexane, heptane, and 2,4-dimethylpentane. These compounds were chosen to study the response of methyl groups to radiation. The G-value ratios of olefinic to dimeric products suggest that olefin formation occurs primarily in the ionization track whereas dimer formation occurs mainly in the bulk of the liquid. The incorporation of catalytic amounts of an oil-soluble boron compound in the atomic reactor experiments was found to increase the rate of product formation manyfold. (auth)

**10958**
MOLECULAR REARRANGEMENTS. XIV. THE HYDROGEN—DEUTERIUM ISOTOPE EFFECT IN THE PINACOL REARRANGEMENT OF TRIARYLETHYLENE GLYCOLS. Clair J. Collins, William T. Rainey, William B. Smith, and Irving A. Kaye (Oak Ridge National Lab., Tenn.). J. Am. Chem. Soc. 81, 460-6(1959) Jan. 20.

The hydrogen—deuterium isotope effects in the acid-catalyzed rearrangement of 1,1,2-triphenylethylene glycol (Iac) and 1,1,2-triphenylethylene-$^2H_1$ glycol (Iefg) have been determined in the presence of several different catalysts to be approximately 3. The first-order rates of rearrangement of the foregoing glycols at 43.3° in aqueous ethanolic 3.13 $\underline{N}$ $H_2SO_4$ have been determined, as have the rearrangement rates of 1,1-diphenyl-2-p-tolylethylene glycol (IVa), 1,1-diphenyl-2-p-tolylethylene-$^2H_1$ glycol (IVd), and threo- and erythro-1,2-diphenyl-1-p-tolylethylene glycol (VIII). Each reactant produces an aldehyde and one or two ketones. From (1) a comparison of the rates of appearance of these products, (2) the constancy of the hydrogen–deuterium isotope effect with varying catalyst and (3) the observation that threo- and erythro-VIII are interconverted in 3.13 $\underline{N}$ aqueous ethanolic $H_2SO_4$ more rapidly than they rearrange, the mechanism of the rearrangement is believed to consist of a reversible formation of open carbonium ion in which no participation by neighboring substituents is required, followed by irreversible migration of hydrogen or aryl. The previous[2a] observation that the $k_{\phi}/k_H$ ratio in the rearrangement of I varies from 7.3 to 0.04, depending on catalyst, is explained on the basis of control of these phenyl/hydrogen migration ratios by the relative populations of particular ionic conformations. The intramolecularity of deuterium migration has been established. (auth)

**10959**

THE RADIOLYSIS OF ORGANIC SOLUTIONS. I. ACETONE AS A TRAP FOR HYDROGEN ATOMS. J. D. Strong and J. G. Burr (Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.). J. Am. Chem. Soc. 81, 775-9(1959) Feb. 20.

The irradiation with cobalt-60 γ rays of mixtures of acetone and propanol-2 has shown that addition of acetone is highly effective in reducing the yield of hydrogen from propanol-2, whereas the yields of methane and carbon monoxide are almost unaltered. Irradiation of mixtures of propanol-2 with 5% acetone-$d_6$ produced methane, 3.2% of which derived from the acetone and hydrogen containing 3.7 atom % deuterium. From these data, from the failure to find biacetyl among the radiolysis products and from the lack of disproportionate increase in the yield of carbon monoxide with addition of acetone, it is concluded that the function of the added acetone is that of a trap for hydrogen atoms rather than that of an energy sink. Comparison of the radiolyses of pure acetone and acetone-$d_6$ shows that the ratio $G(H_2)/G(D_2)$ is 2.66, the ratio $G(CH_4)/G(CD_4)$ is 1.4 and the ratio $G(CO)_H/G(CO)_D$ is 2.1. Irradiation of equimolar mixtures of acetone and acetone-$d_6$ gave hydrogen with $H_2/HD/D_2$ ratios, suggesting that about 80% of the hydrogen was formed via processes other than unimolecular ones, and a $CD_3H/CD_4$ ratio of 5.9 (suggesting a thermal radical mechanism for the formation of methane). Evidence for the presence of "hot" hydrogen atoms in the radiolyses of acetone is discussed. (auth)

**10960**

KINETICS OF $HNO_2$ CATALYZED OXIDATION OF NEPTUNIUM(V) BY AQUEOUS SOLUTIONS OF NITRIC ACID. T. H. Siddall, III and E. K. Dukes (E. I. du Pont de Nemours and Co., Aiken, S. C.). J. Am. Chem. Soc. 81, 790-4(1959) Feb. 20.

The rate-controlling step of the oxidation reaction in the system is shown. The reaction has an activation energy of 12 kcal. The number of hydrogen ions, n, which are involved may be as large as four. The rate of the reaction depends on the fourth power of the concentration of nitric acid. Equilibrium data were obtained. The over-all reaction is slightly endothermic. Equilibrium data are given. Depending on the composition of the aqueous phase, the major fraction of the neptunium may be in the hexavalent state at equilibrium. (auth)

**10961**

THE FLUORINATION OF CARBIDES. Walter C. Schumb and James R. Aronson (Massachusetts Inst. of Tech., Cambridge). J. Am. Chem. Soc. 81, 806-7(1959) Feb. 20.

A group of eight carbides—carbides of silicon, boron, iron, chromium, tungsten, titanium, aluminum, and calcium—representing the various structural types has been fluorinated. The fluorinating agents were elementary fluorine gas and cobalt trifluoride, respectively. The volatile products included low molecular weight, fully saturated fluorocarbons in every case. These products were identified by means of infrared spectroscopy and gas chromatography. No structural correlations between the product fluorocarbons and the original carbides were observed. It is felt that the conditions of fluorination were too drastic for such effects to be seen. (auth)

**10962**

THE RADIATION-INDUCED ISOMERIZATION OF N-ALKYL-N-VINYLSULFONAMIDES. F. W. Stacey, J. C. Sauer, and B. C. McKusik (E. I. du Pont de Nemours and Co., Wilmington, Del.). J. Am. Chem. Soc. 81, 987-92(1959) Feb. 21.

A new reaction, the isomerization of N-alkyl-N-vinylsulfonamides to N-alkyl-2-sulfonylvinylamines, has been discovered. It occurs on exposure of N-alkyl-N-vinylsulfonamides to ionizing radiation. A radical-chain mechanism is postulated which involves an "addition-elimination" sequence in which both the added and eliminated moieties are $RSO_2\cdot$ radicals. A solid-state effect has been observed in a study of the isomerization of several N-alkyl-N-vinylsulfonamides. N-Methyl-N-vinylbenzenesulfonamide and N-methyl-N-vinyl-p-toluenesulfonamide undergo isomerization more readily in the crystalline state than in the liquid state. Conversely, crystalline N-methyl-N-α-styryl-p-toluenesulfonamide is apparently unaffected by radiation dosages which are sufficient to cause extensive isomerization of the liquid. The results are interpreted on the basis of the molecular geometry of the crystalline sulfonamides. (auth)

**10963**

THE CHEMICAL EFFECTS OF γ-RADIATION ON ORGANIC SYSTEMS. PART III. THE ACTION OF RADIATION ON TRIETHYLAMINE ALONE OR MIXED WITH BROMOBENZENE. G. A. Swan, P. S. Timmons, and D. Wright (Univ. of Durham, Eng.). J. Chem. Soc. 9-13(1959) Jan.

Two new bases, meso- and racemic 2:3-bisdiethylaminobutane (II), were isolated from triethylamine which had been irradiated with γ rays and were also synthesized chemically. When the irradiation was carried out in the presence of bromobenzene, in addition to these two bases, diethylaniline, diphenyl, and triethylamine hydrobromide were obtained. (auth)

**10964**

EFFECT OF IONIZING RADIATIONS ON AQUEOUS SOLUTIONS OF OXALIC ACID: AQUEOUS OXALIC ACID USED AS CHEMICAL DOSIMETER FOR DOSES BETWEEN 1.6 AND 160 MRADS. Ivan Draganić (Institut des Sciences nucleaires "Boris Kidritch," Vintcha, Yugoslavia). J. chim. phys. 56, 9-15(1959) Jan. (In French)

The effects of penetrating radiations from $Co^{60}$ and a reactor were studied under various conditions of temperature, radiation intensity, pH, absorbed dose, and initial concentrations of oxalic acid. The possibilities of using this system for dosimetry of high doses were considered. A method of use is proposed for measurement of doses between 1.6 and 160 Mrads. Some considerations on the mechanism of radiolysis are given. (tr-auth)

**10965**
EFFECT OF IONIZING RADIATIONS ON AQUEOUS SOLUTIONS OF OXALIC ACID: RADIOLYSIS IN PRESENCE OF OXYGEN. Ivan Draganić (Institut des Sciences nucléaires "Boris Kidritch," Vintcha, Yugoslavia). J. chim. phys. 56, 16-17(1959) Jan. (In French)

The radiolysis of aqueous solutions of oxalic acid in the presence of oxygen was studied using $Co^{60}$ as a radiation source. A stream of oxygen flowed through the solution during the irradiation. The experimental results show that in the gaseous phase carbon dioxide and hydrogen are present, but only the oxalic acid is present in the liquid phase. It was determined that the molecular yields of the radiolysis are independent of the initial oxalic acid concentration for concentrations $\geq 50$ mM $H_2C_2O_2$/l. The hydrogen yield is low. A mechanism for the radiolysis is proposed. (J.S.R.)

**10966**
EFFECTS OF IONIZING RADIATIONS ON AQUEOUS SOLUTIONS OF OXALIC ACID: EFFECT OF pH ON THE YIELD OF RADIOLYSIS IN THE ABSENCE OF OXYGEN. Ivan Draganić (Institut des Sciences nucléaires "Boris Kidritch," Vintcha, Yugoslavia). J. chim. phys. 56, 18-20(1959) Jan. (In French)

The effect of pH on the radiolysis yields of oxalic acid solutions in the absence of oxygen was studied. The results showed that the effect of pH is independent of the initial concentration of the acid and of the type of radiation. An increase in pH decreases the radiolysis yield. A probable hypothesis for the effect of the pH on the radiolysis yield is given. (J.S.R.)

**10967**
X-IRRADIATION OF AQUEOUS BENZENE SOLUTIONS. J. H. Baxendale and D. Smithies (Univ. of Manchester, Eng.). J. Chem. Soc., 779-83(1959) Feb.

The yields (G molecules/100 ev) of phenol, diphenyl, hydrogen peroxide, and hydrogen from x-irradiated aqueous benzene solutions have been measured in various conditions. In de-aerated solutions $G(Ph \cdot OH) = 0.34$, $G(Ph_2) = 0.55$, and $G(H_2) = 0.60$, independently of dose and the same in neutral and in 0.1N sulfuric acid solutions. $G(H_2O_2)$ varies with dose, benzene concentration, and acidity owing to the fact that hydrogen peroxide takes part in secondary reactions. In the presence of oxygen $G(Ph \cdot OH)$ and $G(H_2O)$ increase substantially and $G(Ph_2)$ falls to zero. Addition of $Cu^{2+}$ and/or $Fe^{3+}$ to de-aerated solutions also increases $G(Ph \cdot OH)$ and decreases $G(Ph_2)$. There is evidence for unidentified reduction products in the de-aerated solutions, and for other oxidation products in aerated solutions and in solutions containing $Cu^{2+}$ and $Fe^{3+}$. (auth)

**10968**
PRODUCTION OF AMIDE GROUPS AND AMMONIA IN THE RADIOLYSIS OF AQUEOUS SOLUTIONS OF PROTEIN. Winifred Bennett and Warren M. Garrison (Univ. of California, Berkeley). Nature 183, 889(1959) Mar. 28.

Results from studies of the amide and ammonia content of reaction products formed by γ-ray-induced oxidation of aqueous gelatin are given. (J.H.M.)

**10969**
SOME KINETICS OF THE INDIRECT EFFECT OF IONIZING RADIATION ON AQUEOUS SOLUTIONS. F. Hutchinson and D. A. Ross (Yale Univ., New Haven.). Radiation Research 10, 477-89(1959) Apr.

The relationship between solute concentration and the dose to inactivate to 37% of the solute activity in dilute aqueous solutions is shown experimentally to be a straight line for four organic solutes. The linear relationship is confirmed by an analysis, and the slope is shown to be the reciprocal of the ionic yield of the solute. From experiments in which solutes are irradiated with various additives present in solution, the ratio of the reactivity for radicals of the additive to that of the solute can be determined. These ratios are shown in four cases to be unity within experimental error. (auth)

**10970**
STUDIES ON THE SALICYLATO COMPLEXES OF URANIUM(VI). Nihar Kumar Dutt and Nityananda Goswami (University Coll. of Science, Calcutta). Z. anorg. u. allgem. Chem. 298, 265-9(1959) Jan.

The composition and stability of the salicylato-complex of uranium were determined. The composition of the complex was found by the method of Job to be $H_2[UO_2(O \cdot C_6H_4 \cdot COO)_2]$. The stability of the complex was of the order of $1.24 \times 10^{-5}$. (auth)

**10971**
KERNCHEMIE. (Nuclear Chemistry.) RCN Mededeling Nr. 3, 1958. J. H. de Boer, A. H. W. Aten, Jr., E. Havinga, and M. E. A. Hermans. s'Gravenhage, Netherlands, Reactor Centrum Nederland, 1958. 110p.

A short historical survey is presented of the development of the concepts of nuclear chemistry, such as the atom, isotope, and the primary components of the nucleus. The inorganic aspects of nuclear chemistry, such as the discovery of artificial isotopes, tracer studies, activation analysis, and the Szilard-Chalmers processes, are discussed. The scope of the applications of isotopes in organic chemistry is illustrated by some examples. The technical application of nuclear chemistry to the breeding ratio of reactors and fuel and construction material processing is considered. (J.S.R.)

## Separation Processes for Pu and U

**10972** CF-58-5-62
Oak Ridge National Lab., Tenn.
VOLATILITY PILOT PLANT—WASTE SALT TRANSFER STUDIES. J. B. Ruch. May 21, 1958. 15p. Contract [W-7405-eng-26]. \$3.30(ph), \$2.40(mf) OTS.

The Volatility Pilot Plant waste salt transfer operation was simulated with water in clear tubing and glass equipment to demonstrate hydraulically the feasibility and desirability of transferring the salt by a siphoning method. Surge chambers placed in the vertical legs of the freeze valve loops were found necessary to produce a satisfactory seal. (auth)

**10973** CF-58-5-112
Oak Ridge National Lab., Tenn.
EQUIPMENT CHECKOUT PRIOR TO ARE PROCESSING, VOLATILITY PILOT PLANT RUN B-1. C. L. Whitmarsh. May 29, 1958. 14p. Contract [W-7405-eng-26]. \$3.30(ph), \$2.40(mf) OTS.

The head-end system for the ARE salt was tested with barren salt and shown to be operable. Transfer of the final batch of salt by gravity flow from the hold tank was shown to be feasible with a redesigned feed salt freeze valve. The CRP trap was also redesigned but the remote dumping mechanism did not function properly. (auth)

**10974** CF-58-5-113
Oak Ridge National Lab., Tenn.
A SERIES OF SEVEN FLOWSHEET STUDIES WITH NONRADIVE SALT, VOLATILITY PILOT PLANT RUNS C-9 THROUGH C-15. C. L. Whitmarsh. May 12, 1958. 62p. Contract [W-7405-eng-26]. $10.80(ph), $3.90(mf) OTS.

A series of seven flowsheet demonstrations of the Volatility Process was performed using nonirradiated material. In this series (a) the Pilot Plant was proven to be operable but not sufficiently reliable for remote operation; (b) the feasibility of a bed of NaF pellets as a trap for Cr and Zr fluorides was demonstrated; and (c) the most desirable fluorine flow rate for fluorination of molten salt in the existing equipment was determined to be in the range 10 to 30 std. liters per min. (auth)

**10975** CF-58-6-4
Oak Ridge National Lab., Tenn.
THOREX, ANALYSIS OF MODIFICATION COSTS. R. V. Foltz and W. R. Winsbro. June 1, 1958. 30p. Contract [W-7405-eng-26]. $6.30(ph), $3.00(mf) OTS.

Actual design and construction costs and schedules for a group of four short-cool processing modifications to the Thorex Pilot Plant are analyzed and summarized. (auth)

**10976** CF-58-7-53
Oak Ridge National Lab., Tenn.
THOREX PILOT PLANT: CRITICALITY REVIEW OF THE THOREX PILOT PLANT USING THE INT-23 PROCESS. W. T. McDuffee and O. O. Yarbro. July 8, 1958. 5p. Contract [W-7405-eng-26]. $1.80(ph), $1.80(mf) OTS.

The results of a criticality review of the ORNL Thorex pilot plant are presented for the condition where a low TBP (INT-23) flowsheet is used in recovering $U^{233}$ from irradiated thorium. Criticality control will be maintained by limiting the $U^{233}$ inventory in the solvent extraction system to less than 550g by means of stream-volume and $U^{233}$ material balances determined at 8 hr intervals. Equipment modification and improved operating procedures for safe plant operation are outlined. (auth)

**10977** CF-58-7-129
Oak Ridge National Lab., Tenn.
SOLVENT EXTRACTION APPLIED TO REACTOR FUEL PROCESSING; FIRST QUARTER CO-OP REPORT. W. E. Dunn. July 14, 1958. 12p. Contract [W-7405-eng-26]. $3.30(ph), $2.40(mf) OTS.

The solvent extraction of thorium with 42.5% TBP in a Decalin diluent was studied in a compound pulse column. The HETS for the extraction section of the column was 4.7 feet. A discussion of the method of graphical calculations of a compound column is included. (auth)

**10978** CF-59-1-23
Oak Ridge National Lab., Tenn.
EVALUATION OF THE TURCO 4501 PROCESS FOR DECONTAMINATION OF THE THOREX DISSOLVER. J. R. Parrott. Jan. 12, 1959. 10p. Contract [W-7405-eng-26]. $1.80(ph), $1.80(mf) OTS.

The Thorex dissolver was decontaminated with Turco reagents after four years operation. The Turco system of decontamination proved far superior to the previously used caustic-tartrate-nitric acid method. (auth)

**10979** HW-30588
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
TEFLON BELLOWS PULSE GENERATORS FOR SOLVENT EXTRACTION PULSE COLUMNS. P. B. McCarthy. Jan. 1, 1954. Decl. Jan. 11, 1955. 11p. Contract W-31-109-Eng-52. $3.30(ph), $2.40(mf) OTS.

A Teflon bellows-type pulse generator is described which consists of two 3-in. nominal diameter Teflon bellows mounted on either end of a flanged spool piece and rigidly connected internally by a push rod so that the two bellows move in tandem. The ends of the two bellows are closed by means of blind flanges. The spool piece is designed for insertion in a 6-in. diameter nozzle on a solvent extraction pulse column. The double bellows arrangement constitutes a safety feature to prevent loss of the column contents in the event of failure of the inner bellows in contact with column solution. Failure of the inner bellows may be detected by a conductivity probe mounted in the air space inside of the double bellows assembly. Reciprocating motion is imparted to the bellows by means of an electrically driven crank arm rigidly connected through a cross head and push rod to the face of the external bellows flange. The push rod is guided by means of linear ball bushings. Frequency variation over a range of 30 to 100 cycles/min. was obtained by use of a Thymotrol-controlled electric motor to drive the crank arm. Variable stroke adjustment (0 to 1-in. range) was possible by adjustment of linkages on the crank arm. A load compensating spring was found desirable to counteract the thrust on the push rod resulting from the static pressure at the bottom of the solvent extraction column. Without the spring, accelerated wear of the bearing on the crank arm occurred. The pulse generator operated uneventfully for 1776 hours ($6.61\times 10^6$ cycles) at a frequency of 62 cycles/min. and a bellows travel of 1-in. (equivalent to a displacement of 1.6 in. in a 3-in. diam. column). (auth)

**10980** HW-58600
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
PRELIMINARY DAREX FLOWSHEET. J. J. Shefcik and A. M. Platt. Dec. 18, 1958. 8p. Contract W-31-109-Eng-52. $1.80(ph), $1.80(mf) OTS.

The preliminary Darex flowsheet for a Yankee fuel provides a two-step process for the total dissolution of stainless steel clad uranium fuels in a mixture of hydrochloric and nitric acids (aqua regia) and the removal of excess chloride from the dissolver solution by a batch volatilization procedure. Four major pieces of equipment are indicated, a dissolver-evaporator, a down draft condenser, a condensate receiver, and a caustic scrubber. The first three pieces of equipment are exposed to aqua regia and must be constructed of a corrosion resistant material such as titanium. Metallic copper is added (in contact with the fuels) as an activator to prevent passivation effects. Under these conditions, the dissolution of cladding proceeds smoothly. (auth)

**10981** IDO-14457
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
IDAHO CHEMICAL PROCESSING PLANT TECHNICAL PROGRESS REPORT FOR JULY THROUGH SEPTEM-

BER 1958. C. E. Stevenson. Feb. 2, 1959. 72p. Contract AT(10-1)-205. $2.00(OTS).

A gummy substance having the characteristics of uranyl dibutyl phosphate was obtained by concentration of intercycle product solution. The extractability of uranium by tributyl phosphate was little affected by low concentration of DBP in the presence of fission product levels of zirconium; extractability of zirconium was strongly increased by similar concentrations of DBP. Studies of interfacial tensions in typical solvent systems containing DBP, zirconium, and silica indicated relatively small effects of these components. The activation energy for uranium transfer was obtained from kinetic measurements. In studying the continuous dissolution of aluminum alloys, moderately high rates were observed with high (11M) nitric acid feed concentration. Packing factors were measured for round rods of varying dimensions. A photometric monitor for detecting uranium at less than gram/liter levels in acid aluminum nitrate raffinate solutions has been developed and tested for over 3000 hours of operation, including plant service. The dynamics of a double diaphragm extraction column pulsing system were investigated. An automatic fluid charge compensation system, based on pressure equalizing connections, was developed for stiff-diaphragm systems. The solubility of air in pulse transmission fluids was measured. Service tests of a canned rotor pump with ceramic-coated components were continued to 2300 hours of satisfactory operation. Modifications to the hydrofluoric acid zirconium process, aimed to produce a homogeneous dissolver product from 2 to 3 percent uranium compositions, have been studied. A dilute process (1.1M Zr in dissolver product) is straightforward in its application but will result in reduced zirconium capacity. A process using 1 to 1.5M nitric acid in hydrofluoric acid is limited by dissolver corrosion. In all these processes concentration of raffinate will be limited to about 0.7 to 0.8M zirconium. In studies of dissolving Zircaloy in nitric-hydrofluoric acid mixtures, initial nitric acid concentrations above 2M were found to have little effect on dissolution rate. Tin-bearing precipitates were observed to form at high acid concentrations. The addition of oxalic acid accelerated dissolution somewhat. Solid phases separated from these systems were further studied. A finely divided solid separated in the anodic dissolution of zirconium in hydrochloric acid. Dibutyl butylphosphonate was shown to be very effective in extracting zirconium from nitrate solutions. The presence of fluoride reduces zirconium extraction and its mole ratio to zirconium in the extract is always less than in the raffinate. Precipitation of a zirconium fluoride compound eventually results. In studies of the fluid bed calcination process for aluminum nitrate wastes, it was determined that alumina from which some strontium and the bulk of the cesium had been leached by dilute nitric acid would yield very little additional fission products upon several months' additional contact with water. Silica gel used to absorb ruthenium from calciner off-gas lost little ruthenium either when heated to 200°C or washed with carbon tetrachloride. A kaolin catalyst was inferior to silica gel in absorbing ruthenium; a porous glass was an efficient absorber but it was difficult to elute ruthenium from it. Difficulties in obtaining sustained operation of a small calciner planned for full activity level tests continued to be encountered. Preliminary tests of heating a large calciner with direct-fired tubes showed some promise. Heat transfer coefficients to a tube in the pilot plant calciner fluidized bed were measured. Studies of the effect of the ratio of atomizing air to feed volume in the small pilot plant calciner generally showed that fines production was increased by high air ratios. In studies of the extraction of aluminum from acetate-buffered wastes by acetylacetone, cerium was found to accompany aluminum significantly. A new technique was explored for separating stainless steel fuel components from wastes. This consists of mercury cathode electrolysis, the deposited metals being continuously removed from the mercury by circulation and washing. High decontamination of the metals from cesium, cerium, zirconium, and strontium was achieved, but ruthenium was carried with the deposited metals. Some difficulty was experienced with mercurous sulfate precipitation. Tests were carried out with beds of activated charcoal for removing iodine from barium-140 process off-gas. Decontamination factors of 10 to 35 were observed. A spectrophotometric method for determining microgram levels of zirconium based on fuming with sulfonic acid, Versene addition, and color development with pyrocatechol violet was developed. The analytical procedure for neptunium determination in process feed samples was simplified to require only extractions for zirconium removal and plutonium separation. (auth)

**10982** KLX-1745

Vitro Corp. of America. Vitro Engineering Div., New York.

A CONCEPTUAL DESIGN AND COST STUDY FOR CHEMICALLY PROCESSING IRRADIATED REACTOR FUELS. Job 7011. Aug. 1, 1955. Decl. April 1, 1959. 64p. $12.30(ph), $4.50(mf) OTS.

A conceptual design for a reprocessing facility has been prepared based on reprocessing 1,000 lb/day of irradiated fuel. The fuel alloy composition has been assumed to be 20% total uranium and 80% zirconium. The uranium had an assumed enrichment of 5% $U^{235}$ prior to irradiation at 10,000 mwd/t. In the irradiation process, 300 grams of plutonium have been produced (this is equivalent to 3,000 grams of plutonium for each ton of uranium irradiated). The spent fuel as fed to the reprocessing plant has an enrichment of 3% $U^{235}$. Investigations indicate that the facility design incorporates sufficient flexibility to reprocess highly enriched irradiated fuels such as STR Mark 1, at a rate of 4.5 kg-U/day. Plant design has been based on a direct maintenance philosophy and as a result design emphasis is directed toward an elimination of minor trouble spots through careful selection of equipment, instrumentation, etc., and sparing of critical items. The main facility consists of a processing area and a service area. The processing area contains concrete cells designed to house the process equipment and contain the radioactivity. A storage canal for fuel elements separates the processing area from the service area. The service area contains offices, maintenance shop, personnel facilities, and the laboratory. Requirements for operating personnel total 124 employees and an organization chart of the operating and supervisory personnel has been presented. (auth)

**10983** ORNL-2661

Oak Ridge National Lab., Tenn.

THE FUSED SALT-FLUORIDE VOLATILITY PROCESS FOR RECOVERING URANIUM. G. I. Cathers, M. R. Bennett, and R. L. Jolley. April 15, 1959. 33p. Contract W-7405-eng-26. $1.00(OTS).

A fluoride volatility process for recovering enriched uranium from $UF_4-NaF-ZrF_4$ melts, produced by the dissolution of reactor fuel elements in molten $NaF-ZrF_4$ through hydrofluorination, is described. The $UF_4$ is fluorinated to $UF_6$, which volatilizes, and is separated from volatile fission products in a NaF absorption-desorption cycle. In laboratory studies gross beta and gamma decontamination factors of $10^5$ with a uranium loss of less than 0.1% were secured. The product $UF_6$ may be conveniently returned to $UF_4$ or metal for further use as reactor fuel. Chemical studies, supplementary to process development work, showed that impurities, possibly oxides, have a much greater effect in the fused salt-fluorination step than such factors as use of nitrogen with the fluorine, or the method of introducing the fluorine into the fluoride melt. The colloidal behavior of $NiF_2$, a slightly soluble corrosion product formed in the fluorination, indicated that this material would not interfere in molten salt handling if the fused salt was not allowed to stand without agitation for prolonged periods. The absorption of $UF_6$ in NaF was found to be due to the formation of a $UF_6-NaF$ complex. The equilibrium between gaseous $UF_6$ and solid complex was established for the temperature range of 80 to 320°C. Decomposition of the $UF_6-NaF$ complex to a $UF_5-NaF$ complex does not lead to appreciable uranium loss in the process if specified process conditions are maintained. (auth)

**10984** ORNL-2668
Oak Ridge National Lab., Tenn.
EXTRACTION OF PROTACTINIUM WITH DIISOBUTYLCARBINOL. J. R. Oliver, J. R. Meriwether, and R. H. Rainey. April 15, 1959. 13p. Contract W-7405-eng-26. $0.50(OTS).

Conditions for extracting protactinium from solutions of irradiated thorium by diisobutylcarbinol (DIBC) (2,6-dimethyl-4-heptanol) were determined in laboratory tracer experiments. Protactinium was extracted from a solution containing 1.0 M thorium, 0.6 M $Al(NO_3)_3$, and 4.0 M $HNO_3$. Impurities were scrubbed from the organic phase with a solution containing 0.6 M $Al(NO_3)_3$ and 2.0 M $HNO_3$. Feed/organic/scrub volume ratios were 1/0.4/0.75; there were 4 extraction and 5 scrub stages. Protactinium was stripped from the organic with 1.0 M $HNO_3$ containing 0.05 M fluoride. The extraction was made at 50°C to decrease emulsion formation. Under these conditions more than 99.5% of the protactinium was extracted. Decontamination factors from uranium, thorium, zirconium-niobium, and the rare earths were $6 \times 10^2$, $6 \times 10^4$, $5 \times 10^3$, $2.5 \times 10^2$, and $4 \times 10^3$, respectively. (auth)

**10985**
EXTRACTION OF URANYL CHLORIDE BY TRI-n-OCTYLAMINE. Jean Bizot and Bernard Trémillon (Ecole de Physique et de Chimie, Laboratorie de Chimie Analytique, Paris). Bull. soc. chim. France No. 1, 122-6(1959) Jan. (In French)

The long-chained aliphatic amines are among the organic substances used to extract mineral compounds. The extraction of uranyl chloride with tri-n-octylamine in carbon tetrachloride was studied quantitatively. In the presence of hydrochloric acid the trioctylamine forms a hydrochloride soluble in organic solvent, with the result that the hydrochloric acid is in competition in the extraction of the uranyl salt. The compound extracted has the formula $(R_3NHCl)_2(UO_2Cl_2)$, where $R_3N$ designates the trioctylamine. The extraction equilibrium constants were determined, and the law of mass action was verified. It is only in strongly acid medium that the uranyl chloride can be quantitatively extracted. (tr-auth)

**10986**
ON THE INTERACTION OF OXALATE URANYL COMPLEXES WITH HYDROGEN PEROXIDE. E. V. Komarov and A. M. Gurevich (Zelinskii Radium Inst., Academy of Sciences, U.S.S.R.). Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk. No. 3, 547-50(1959) Mar. (In Russian)

Light absorption and pH measurements were made on the $UO_2^{2+}-C_2O_4^{2-}-H_2O_2-H_2O$ system with uranium concentrations of $5 \times 10^{-4}$ to $4 \times 10^{-8}$ M. The experiments uncovered new complex anions of $(UO_2C_2O_4)_2(OO)^{2-}$ and $(UO_2)_2(OO)(C_2O_4)_4^{6-}$. Equilibrium constatns for their formation were calculated. The solid phases of $(NH_4)_2(UO_2)_2(OO)(C_2O_4)_2 \cdot XH_2O$ and $(HOOUO_2C_2O_4)\ NH_4 \cdot XH_2O$ were separated; however, the solid phase of $R_6(UO_2)_2(OO)(C_2O)_4 \cdot aq$ could not be separated due to its solubility. (R.V.J.)

**10987**
URANIUM ISOTOPE SEPARATION: A NEW INDUSTRY. G. R. H. Geoghegan. New Scientist 5, 468-72(1959) Feb. 26.

The gaseous diffusion separation process used in the British factory at Capenhurst is described, and consideration is given to the economic aspects of the plant. Information is also included on the basic principles of operation of the electromagnetic, gas-phase centrifuge, and jet processes. (J.H.M.)

**10988**
SEPARATION OF URANIUM FROM THORIUM. U. K. Atomic Energy Authority (U.S.A.). British Patent 800,791. Nuclear Eng. 4, 188(1959) Apr.

On exposure of thorium to slow neutrons a small amount of uranium is formed in the irradiated material. From the irradiation product an aqueous solution is prepared of thorium and uranium nitrates, the proportion of nitrate : water ranging from 0.7 : 1 to 1.4 : 1 and the proportion of uranium : thorium not exceeding 1 : 50. This solution is treated with diethyl ether resulting in preferential extraction of the uranium.

**10989**
RECOVERY OF PLUTONIUM. U. K. Atomic Energy Authority (U.S.A.). British Patent 801,379. Nuclear Eng. 4, 188(1959) Apr.

If an aqueous solution of fission products, in which plutonium may be present, is brought into contact with diatomaceous earth, silicon gel, or magnesium silicate, the plutonium will be adsorbed preferentially to uranium or other fission materials. The adsorbed plutonium may be eluted with 6N nitric acid.

**10990**
SEPARATION OF PLUTONIUM. U. K. Atomic Energy Authority (U.S.A.). British Patent 801,520. Nuclear Eng. 4, 188(1959) Apr.

The separation of plutonium from fission products in aqueous solutions is effected by forming a water-insoluble complex of plutonium with cupferron. The complex is probably chelate. The method can be employed in an advanced phase of the process of isolating plutonium from neutron irradiated uranium.

**10991**
ELECTRICAL PRECIPITATION OF URANIUM ON A COPPER CATHODE. P. I. Chalov. Trudy Inst. Geol. Akad. Nauk Kirgiz. SSR No. 9, 231-5(1957). (Translated from Referat. Zhur. Met. No. 8, 1958, p. 68.)

A study was made of the electrical deposition of U from an acetate medium on a Cu cathode, with the object of obtaining U preparations in layers of infinite thinness without the use of Pt cathodes. Simultaneously, a study was made of the coprecipitation of a thorium isotope $Th^{234}$. Precipitation was performed on Cu disks 40 mm in diameter and 0.5 mm thick; a revolving Pt cone served as anode. Cathode potential was monitored by a mercury-sulfate half cell. The electrolyte contained 1 mg U and 3 g Na acetate. Its volume was ~150 cc. In the majority of experiments the electrolyte also contained 0.2 cc glacial acetic acid. The following were found to be the optimum conditions for electrical precipitation of U: Cathode potential from −0.87 to −0.93 v, solution temperature 80 to 95°C, pH 5.75 to 5.89, electrolysis time 40 to 60 min. Under these conditions 95 to 96% of the U and 50–60% of the $Th^{234}$ precipitated at the cathode. This often necessitates prior removal of the $Th^{234}$ from the solution.

**10992**
APPLICATION OF SODIUM DIETHYLDITHIOCARBAMATE IN URANIUM SEPARATION FROM VARIOUS ELEMENTS. E. S. Przheval'skii, E. R. Nikolaeva, and N. S. Klemova. Vestnik Moskov. Univ. Ser. Mat. Mekhan. Astron. Fiz. i Khim. 13, No. 3, 217-20(1958) Nov.-Dec.

A sodium diethyldithiocarbamate method of uranium extraction from Th, Al, Fe, and V is described. It is shown that a quantitative extraction of uranium diethyldithiocarbamate by organic solvent can be reached with pH 6.5 to 7.5; hence uranium can be separated from elements which do not form diethyldithiocarbamate under the same conditions. It was also found that nitric acid (1 : 20) and saturated ammonium carbonate solution can achieve complete uranium extraction into the aqueous phase from the organic solvent. A separation method was developed for small quantities of uranium (hundredths of mg) from iron. The separation of uranium and vanadium was achieved by vanadium diethyldithiocarbamate extraction from acid solution at pH 0.4 to 0.5. (R.V.J.)

## CONTROLLED THERMONUCLEAR PROCESSES

**10993** CF-56-2-152
Oak Ridge National Lab., Tenn.
PROPOSED SHERWOOD EXPERIMENT. John S. Luce. Feb. 29, 1956. Decl. Nov. 12, 1958. 10p. $1.80(ph), $1.80(mf) OTS.

An experiment is proposed which will indicate the possibility of producing a high temperature plasma by injecting energetic molecular ions into a volume and trapping the resulting atomic ions. The success of the method depends on reduction of neutral ion pressure. (D.E.B.)

**10994** CF-58-11-95
Oak Ridge National Lab., Tenn.
SOME CHEMICAL PROBLEMS ASSOCIATED WITH THERMONUCLEAR REACTORS. W. Davis, Jr. Nov. 10, 1958. 8p. Contract [W-7405-eng-26]. $1.80 (ph), $1.80(mf) OTS.

A number of reports on fusion or fusion-fission reactors has been reviewed to enumerate some of the chemical and chemical engineering problems that will be associated with this program for economic power production. Some of these problems, which have either been stated or implied are: (1) production of an initial tritium inventory of at least 40 kg if a D-T reactor is to be used; (2) development of a rapid process for separating $D_2$ and $T_2$ from a mixture with less than a few per cent He; (3) development of a tritium breeding blanket that will not produce products that are deleterious to the integrity of materials of construction; (4) development of processes for nearly complete recovery of tritium from the breeder blanket when the tritium concentration is only in the order 0.1 atom per cent; (5) development of means of using neutron multiplication reactions in the breeder blanket; (6) development of processes for converting uranium of low U-235 content (such as Paducah reject $UF_6$) to some other form, should a fusion-fission reactor be deemed advantageous; (7) development of water purification systems (or other liquid coolant systems) to the point where corrosion of copper used in magnet construction will be at tolerably low levels. Each of these problems, and others that present themselves, should be studied in more detail so that necessary research and development can be performed before the solution is required in the normal course of fusion reactor development. (auth)

**10995** LA-2046
Los Alamos Scientific Lab., N. Mex.
NONWEAPONS ACTIVITIES AT LOS ALAMOS SCIENTIFIC LABORATORY. PART I. CONTROLLED THERMONUCLEAR REACTIONS. Samuel Glasstone. June 1956. Decl. April 1, 1959. 46p. Contract W-7405-eng-36. $7.80(ph), $3.30(mf) OTS.

Basic principles underlying thermonuclear reactions and methods for controlling these reactions are discussed. Thermonuclear research being done at Los Alamos Scientific Laboratory is reviewed. Descriptions are included of the Perhapsatron, Columbus Devices, Magnetic Induction Machine, and the Picket Fence Principle.

**10996** LWS-24920(Rev.)
California Research and Development Co., Livermore, Calif.
PROPOSAL FOR A DRIVEN THERMONUCLEAR REACTION. Fred Powell. Oct. 6, 1953. Decl. Mar. 27, 1959. 13p. $3.30(ph), $2.40(mf) OTS.

A thermonuclear power breeder apparatus is proposed which utilizes (d,t) reactions from a D beam incident on a T target. Each reaction produces one 14-Mev neutron which would be inelastically scattered in a $U^{238}$ blanket, producing 4 neutrons for the production of Pu and heat. Preliminary calculations and schematics are given. (D.E.B.)

**10997** NYO-7893
Princeton Univ., N. J. Project Matterhorn.
DETERMINATION OF MACHINE TRANSFORM (IOTA) FOR B-3, USING DATA OBTAINED FROM A CONDUCTING PAPER ANALOGUE. Technical Memorandum No. 46. Kenneth E. Wakefield. June 17, 1957. Decl. Aug. 21, 1958. 20p. $3.30(ph), $2.40(mf) OTS.

The component of magnetic field in a plane perpendicular to the axis of a long, noncurving system of helical, current-carrying conductors is approximately the same as the magnetic field produced by a similarly arranged system of straight, current-carrying conductors if the rate at which the helical conductors rotate, as one travels along the axis, is small. This approximation can be used to construct pseudo-magnetic surfaces by feeding currents, representing conductor currents, into a conducting paper at positions corresponding to the location of these conductors. The equipotentials set up in the conducting sheet represent accurately the stream lines of flux of the magnetic field. Examples of magnetic surfaces determined by this method are shown. The conductor arrangement is that designed for use in the B-3 conductor; however, the rate of conductor rotation (K) may be different. The determination of the most advantageous value of K is examined, and the use of this value to estimate the transform that might be expected for various conditions of machine operation are explored. (J.R.D.)

**10998** NYO-7894
Princeton Univ., N. J. Project Matterhorn.
A PROPOSAL FOR THE B-4 MACHINE. Technical Memorandum No. 47. J. File, R. L. McLean, R. G. Mills, F. Tenney, and D. R. Wells. July 13, 1957. Decl. Nov. 26, 1958. 21p. $4.80(ph), $2.70(mf) OTS.

A preliminary proposal including cost and time estimates is presented for Stellarator B-4. The B-4 machine would be designed to get a large field in a large volume for a relatively long time when operating from the existing B-3 capacitor bank. The first form of the machine would be a race track equipped with stabilizing windings and two removable straight sections, one of which would be equipped for cyclotron resonance heating. (W.D.M.)

**10999** UCRL-4702
California. Univ., Livermore. Radiation Lab.
NEUTRON PRODUCTION IN THE PINCH DUE TO INSTABILITY BREAKUP. Stirling A. Colgate. May 12, 1956. Decl. Oct. 1, 1958. 18p. Contract W-7405-eng-48. $3.30(ph), $2.40(mf) OTS.

The neutrons from the Berkeley linear pinch originate from deuteron collisions with a large net center-of-mass velocity in one direction along the axis of the pinch tube. The interpretation of this result is that the neutron production associated with the pinch is non-thermonuclear in origin. The experimental evidence is reviewed, and a possible source of the neutron production is discussed. (auth)

**11000** UCRL-8062
California. Univ., Berkeley. Radiation Lab.
THE HOMOPOLAR DEVICE. O. A. Anderson, W. R. Baker, A. Bratenahl, H. P. Furth, J. Ise, Jr., W. B. Kunkel, and J. M. Stone. Jan. 1958. Decl. Aug. 21, 1958. 57p. Contract W-7405-eng-48. $9.30(ph), $3.60(mf) OTS.

Of the many interesting rotational plasma configurations, the Homopolar geometry has thus far received most attention. Here a radial electric field and an axial magnetic field are used to set plasma into azimuthal drift motion. A transient radial current flows during the acceleration stage, and this has been used in the experiments reported here to pinch the plasma axially away from insulating end plates. The axial magnetic field employed in practice has been of the mirror machine type. The centrifugal force associated with plasma rotation tends to hold the ions away from the axis, and therefore traps them in the region of bulging field. Axial containment is achieved at first by the azimuthal pinch field and later by the centrifugal trapping effect. Rotational kinetic energy can be converted to plasma heating by viscosity or turbulent mixing. These effects, though more powerful than Joule heating, may not suffice to heat a practical thermonuclear device, and auxiliary heating methods may have to be applied. As with the toroidal stabilized pinch, a promising containment method has been demonstrated, but the adequacy of self-heating remains to be determined. As in the study of the pinch effect, a natural course of development is from small, high-density models to large, low-density machines. A deuterium density of about $10^{13}$/cc should be satisfactory in a thermonuclear reactor. Experiments were directed exclusively to documenting the physics of rotating plasmas. Argon was used for the most part. Great stress was placed on direct methods of measuring actual plasma rotation. Circuit responses have demonstrated participation of the entire starting gas in the rotation. Plasma angular momentum has been measured unambiguously as a function of time, by "crowbarring" the machine and observing the charge drawn out. Ion kinetic energies above 500 ev in argon and 50 ev in deuterium were demonstrated. Doppler-shift measurements indicate, if anything, still larger energies. The presence of very high $\beta$'s was shown by deformation of the starting magnetic field. For 5-$\mu$sec plasma-acceleration times, substantial plasma rotation has been observed up to 80 $\mu$sec later. A larger system, having thermonuclear potentialities, was completed and another is being built. An important incidental use of the Homopolar machine is as a fast-discharge capacitor. Dielectric constants of $10^6$ to $10^7$ were produced with ease, and output-current rates of rise of $5 \times 10^{11}$ amp/sec were generated. (auth)

## CRITICALITY STUDIES

**11001** CF-58-9-77
Oak Ridge National Lab., Tenn.
REQUEST FOR PRELIMINARY CRITICALITY REVIEW OF REACTOR FUEL REPROCESSING SCHEMES. A. R. Irvine, J. M. Holmes, J. P. Nichols, and A. C. Schafer, Jr. Sept. 24, 1958. 39p. Contract [W-7405-eng-26]. $7.80(ph), $3.30(mf) OTS.

Reprocessing schemes for Consolidated Edison Thorium Reactor, Special Stainless Steel, and Foreign Research Reactor Fuels are described for purpose of examination by Criticality Review Board. (auth)

## GEOLOGY AND MINERALOGY

**11002** NAA-SR-Memo-791
North American Aviation, Inc., [Downey, Calif.].
A RESEARCH PROPOSAL ON THE RECOVERY AND PURIFICATION OF URANIUM AND VANADIUM FROM LOW GRADE ORES BY GAS PHASE HALOGENATION. E. Motta and F. Rosen. Sept. 29, 1953. Decl. Nov. 6, 1958. 13p. $3.30(ph), $2.40(mf) OTS.

A research proposal is presented on the direct separation of volatile U and V halides from U-bearing ores by means of a continuous gas-phase high-temperature halogenation. The work is directed toward cutting costs in raw materials processing. In the proposed process U and V halides are volatilized away from the bulk ore, reducing the scale of the process by a factor of 100 in the first step. The process lends itself to rapid continuous operation based on gas flow, and cost projections indicate that the halogenation method should cost no more than half as much as present processes. (auth)

**11003**
V. RADIOACTIVITY OF SOME HOT SPRINGS IN THE AREA OF ORADEA AND HUNEDOARA (TRANSYLVANIA) [RUMANIA]. Arpad Szabo and Attila Soós (Ruma-

nian Academy). Acad. rep. populare Romine. Inst. fiz. atomică IFA/R/10 9p.(1956). (Translated from Referat. Zhur. Khim. No. 8, 1958, Abstract No. 24666.)

Determinations have shown that the hot springs of the Oradea region are of low radioactivity. In the springs of the Victoria and "May First" resorts, the radon content is 0.21 to 0.41 $\mu$ c/l, and the radium content varies from minute traces to $3.71 \times 10^{-12}$ g/l. In the region of Hunedoara, among the springs of the Dzhordzhiu spa, there are several springs with a radon concentration of 0.16 to 3.32 $\mu$ c/l, and a radium concentration of 0.21 to $8.21 \times 10^{-12}$ g/l. (J.S.R.)

**11004**

STUDY OF PRESENCE OF RADIUM IN PRECIPITATES DEPOSITED BY MINERAL WATERS. PART II. G. Atanasiu (Academy of Sciences of Rumania). Acad. rep. populare Romine. Bul. stiint., Sect. stiinte mat. fiz. 9, 145-58(1957). (Translated from Referat. Zhur. Khim. No. 10, 1958, Abstract No. 32101.)

The enrichment of precipitates deposited by mineral waters with radium is explained by the fact that rain waters dissolve Ca and Mg carbonates. These tuffs contain only Ra and products of its decay. U is absent; this peculiarity was used for the determination of the age of tuffs (for example, the age of one tuff was about 8270 years). Some tuffs are not radioactive because of their age. The increased radioactivity of some tuffs is explained by the fact that water passes through tuffs with increased Ra concentration before reaching the surface.

**11005**

STUDY OF RADON, RADIUM AND URANIUM CONCENTRATION DEGREES IN MINERAL WATERS AND CALCAREOUS TUFFS ON SINGEORZ-BAI (CLUJ DISTRICT). A. Szabo and A. Soós (Academy of Sciences of Rumania). Acad. rep. populare Romine, Bul. stiint., Sect. stiinte mat. fiz. 9, 159-63(1957). (Translated from Referat. Zhur. Khim. No. 10, 1958, Abstract No. 32117.)

The results of Rn concentration measurements in carbonate waters of the Singeorz-Bai health resort are presented. During 30 years the Rn content has not changed noticeably. The content of metallic Ra is 8 to $20 \times 10^{-12}$ g/l in water and 12 to $15 \times 10^{-12}$ g/l in calcareous tuffs deposited by the water. Neither the water nor the tuffs contain U in determinable quantities.

**11006**

MANGANOMOSSITE RESTUDIED. C. Osborne Hutton (Stanford Univ., Calif.). Am. Mineralogist 44, 9-18 (1959) Jan.-Feb.

Manganomossite from Yinnietharra, Western Australia, is metamict columbite with $UO_2$ = 0.96%. The untreated mineral with density = 6.17 and R.I. = 2.27, gives weak, diffuse powder and single crystal patterns with relatively few lines or spots, but after being heated in vacuo at 800°C or at 1200°C for periods of $^3/_4$ hour, the density of the mineral showed an increase to 6.32 in each case, and powders prepared therefrom yielded identical but strong patterns with numerous lines, although some diffuseness remains in the high $2\theta$ region. This x-ray pattern may be indexed for an orthorhombic unit cell with the following dimensions: $a_0$ = 5.09 A, $b_0$ = 14.31 A, $c_0$ = 5.725 A, but it is not possible to index the films on the basis of tetragonal symmetry. Autoradiographs show that zonary distribution of radioactivity may or may not be present, but the mineral appears to be free from radioactive centers or inclusions. A complete analysis of the mineral after elimination of water leads to the formula: $(Mn, Fe, U, Th)_{3.97}(Nb, Ta, Ti)_{7.99}O_{24}$. (auth)

**11007**

THE ELK RIDGE-WHITE CANYON CHANNEL SYSTEM, SAN JUAN COUNTY, UTAH: ITS EFFECT ON URANIUM DISTRIBUTION. Henry S. Johnson, Jr. and William Thordarson (Geological Survey, Grand Junction, Colo.). Econ. Geol. 54, 119-29(1959) Jan.-Feb.

Reconnaissance in the White Canyon district, San Juan County, Utah, indicates that rocks of the Shinarump member of the Chinle formation of Triassic age were deposited in that district in two different channel systems; sediments deposited in channels of one system were derived from a source to the east and sediments of the other from a source to the south. The channel system containing sediments derived from the east, the Elk Ridge-White Canyon channel system, was apparently formed by a large braided stream that flowed westward from a source in granitic and metamorphic terrane of the ancestral Uncompahgre highland. All known uranium deposits of any consequence in the White Canyon district are confined to the Shinarump member deposited in the Elk Ridge-White Canyon channel system. The nature of the channels and the lithologic characteristics of the rocks filling this system of channels combine to form a much more favorable environment for the localization of uranium deposits than do the channels formed and the rocks deposited by northward-flowing streams. Recognition of channel systems in the White Canyon district suggests that channel systems may be recognized elsewhere in the Shinarump member, and that the Shinarump member on the Colorado Plateau may be composed of rocks deposited in many coalescing channel systems. In addition, study in the White Canyon district indicates that rocks deposited in some of these channel systems are more favorable hosts for uranium deposits than the rocks deposited in others. Recognition and delineation of these ancient channel systems may be of help in making regional appraisals of ore potential and in the search for new mining districts. (auth)

**11008**

AN OCCURRENCE OF RHENIUM ASSOCIATED WITH URANINITE IN COCONINO COUNTY, ARIZONA. Richard G. Petersen, John C. Hamilton, and Alfred T. Myers (Geological Survey, Denver). Econ. Geol. 54, 254-67(1959) Mar.-Apr.

Twenty-nine samples of sedimentary rocks of Triassic age from the Sun Valley uranium mine in northern Arizona were analyzed spectrographically; 11 of these samples contained 0.005 to 0.1 per cent of the rare metallic element, rhenium. The rhenium is associated with uranium and molybdenum (and probably with lead and zinc). It is probably in the form of the water soluble oxide ($Re_2O_7$) or perrhenic acid ($HReO_4$). The rhenium may have been contained originally in the mineral jordisite. This is indicated by the association of the rhenium oxide with the water-soluble molybdenum mineral, ilsemannite. The Sun Valley mine is the only uranium deposit on the Colorado Plateau known to contain any rhenium. (auth)

**11009**

STRUCTURAL RELATIONS AT THE HIDEOUT NO. 1 URANIUM MINE, DEER FLAT AREA, SAN JUAN COUNTY, UTAH. Tommy L. Finnell and William B. Gazdik (U. S. Geological Survey, Denver). Econ. Geol. 53, 949-57(1958) Dec.

The Hideout No. 1 mine is located 30 miles west of

Blanding, Utah. Consolidated sedimentary rocks exposed in the vicinity of the mine range in age from Permian to Triassic. The rock units, from oldest to youngest, are the Cedar Mesa sandstone member, the Organ Rock tongue, and the Hoskinnini tongue of the Cutler formation of Permian age, the Moenkopi formation of Triassic age, and the Shinarump member, the mudstone-sandstone unit, and the Moss Back member of the Chinle formation of late Triassic age. The Hideout No. 1 uranium—copper deposit is in the Shinarump member of the Chinle formation where it fills a stream channel cut in the top of the Moenkopi formation. The apparent relation between the uranium—copper deposit and a low amplitude monoclinal fold is explained. The close association of uranium ore in the Hideout No. 1 channel with a local change in dip of the underlying rocks indicates that further work is needed to determine if similar relations exist in other deposits on the Colorado Plateau. (J.E.D.)

**11010**

ON THE HAFNIUM—ZIRCONIUM RATIO IN METAMORPHIC AND METASOMATIC ROCKS. E. Ye. Vaynshteyn, A. I. Tugarimov, A. M. Tuzova, and I. D. Shevaleyevskii. Geokhimiya No. 3, 241-4(1958).

The distribution of zirconium and hafnium in various rock samples was investigated by x-ray spectral analysis. A table gives the $ZrO_2$ and $HfO_2$ content of the samples as well as the $ZrO_2$—$HfO_2$ ratio. This ratio is 20 to 40 in metamorphic rock and up to 112 in metasomatic rock. (W.D.M.)

**11011**

ON THE RATIO OF INDIVIDUAL RARE EARTHS IN GADOLINITE. E. Ye. Vaynshteyn, G. A. Sidorenko, A. I. Tungarinov, and N. V. Turanskaya. Geokhimiya No. 3, 245-7(1958).

Five samples of gadolinite were investigated by means of x-ray spectral analysis as well as radiographically. The relative content of the rare earths with respect to neodymium and the results from the debyegrams of four samples are given. (W.D.M.)

**11012**

THE URANIUM CONTENT IN THE SURFACE OF HUNGARY. I. THE ESTABLISHMENT OF A METHOD OF INVESTIGATING URANIUM; SUCCESSES OF INVESTIGATIONS IN THE EASTERN PART OF HUNGARY. Gyula Almássy, Istvan Dezso, Edit Kovacs, and Janos Straub. Hidrol. Közlöny 37, 162-5(1957). (Translated from Referat. Zhur. Khim. No. 11, 1958, Abstract No. 35801.)

The uranium content in specimens of water was determined by the fluorometer method, through extraction with dibutylphosphate. According to the data, 150 specimens established that the quantity of uranium (gamma/lambda) in the individual specimens reached 15 to 20, seldom 40 to 60; in the majority of regions, the uranium content fluctuated from 1.0 to 10.

**11013**

RADIOCARBON DATING OF THE LATE-GLACIAL PERIOD IN BRITAIN. H. Godwin and E. H. Willis (University Subdepartment of Quaternary Research, Cambridge, Eng.). Proc. Roy. Soc. (London) B150, 199-215 (1959) Mar. 17.

Radiocarbon dating by means of a proportional gas-counter containing carbon dioxide at a pressure of 2 atm. has been applied to the dating of deposits from several widely spaced sites in Great Britain. At each of these sites independent investigations of the stratigraphy and plant remains, and particularly systematic pollen analysis, had demonstrated that the deposits were referable to zones I, II, and III of the Late-glacial Period. Organic samples were taken from carefully defined horizons at these sites. The datings are remarkably self-consistent and indicate that the zones as previously defined are synchronous throughout this country. It seems that the upper and lower boundaries for the cool temperate Allerød phase (zone II) fall approximately at 8800 and 10,000 years B.C., while the succeeding colder phase (zone III) lasted until about 8300 B.C., approximately the time at which the ice-retreat began from the line of the Highland Re-advance in Scotland and from the Central Swedish moraines and Norwegian Raa in Scandinavia, as already suggested by varve-chronology. This is the Late-glacial/Post-glacial boundary. Brief comparison of published radiocarbon dates of the Late-glacial zones in Denmark, northwest Germany and Holland indicate that these also are synchronous with one another and with the zones recognized in Britain. Attention is directed to five substantial sources of error to which datings of this kind are liable: contamination of the original samples by derived coal, the use of organic muds in which carbon has originated from photosynthesis of submerged plants in hard waters, failure to observe gaps in the depositional sequence, the so-called "Suess" effect, and the seepage of organic material from above into older layers. (auth)

**11014**

NUCLEAR GEOPHYSICAL METHODS—AN IMPORTANT RESERVE FOR FURTHER INCREASING THE EFFICIENCY OF GEOLOGICAL PROSPECTING AND SURVEYING. A. L. Yakubocich. Razvedka i Okhrana Nedr No. 8, 29-37(1958).

Some of the nuclear geophysical methods for prospecting and surveying of nonradioactive minerals are described. Neutron activation analysis of core samples is proposed. (W.D.M.)

**11015**

NATURAL RADIOACTIVE DISEQUILIBRIUM OF THE URANIUM SERIES. John N. Rosholt, Jr. U. S. Geol. Survey Bull. 1084-A. 1959. 32p. $0.15.

Many radioactive samples show radioactive disequilibrium because of the numerous geochemical processes affecting ore deposits. As it is difficult to interpret disequilibria by simply comparing radiometric and chemical assay values of uranium, analyses should be made of the abundance of $Pa^{231}$, $Th^{230}$, $Ra^{226}$, $Rn^{222}$, and $Pb^{210}$. Uranium-series disequilibria, as shown by radiochemical studies of samples representing a cross section of most of the significant present-day radioactive deposits in the United States, can be classified according to six basic types. Interpretations of the geochemical history of these types indicate that it may be possible to date uranium deposition within a theoretical range of 2,000 to 200,000 years. Ages ranging between 6,000 and 30,000 years have been calculated for several specific samples. (auth)

## HEALTH AND SAFETY

**11016** AERE-C/R-327

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE MONITORING OF EFFLUENT FOR ALPHA-EMITTERS. A. A. Smales and L. Airey. Apr. 1949. 31p.

A procedure is described for the determination of alpha activity of the Harwell effluent involving the evaporation of the liquid sample followed by counting the dried residue in a scintillation alpha counter. The correction to be applied for self absorption in the sample is discussed theoretically and practically together with other errors which might occur, the principle of the avoidance of systematic negative errors being adhered to as far as possible. Activity due to Sm cannot be detected by this method and that due to radium and its daughters seriously complicates what is otherwise a simple and practicable procedure. It is recommended that these elements should not be allowed into the effluent system. (auth)

**11017** ALI-51
Little (Arthur D.) Inc., Cambridge, Mass.
HAZARDS AND SAFETY MEASURES RELATED TO NUCLEAR-POWERED MERCHANT SHIPS: AN ANNOTATED BIBLIOGRAPHY OF DECLASSIFIED LITERATURE. M. K. White, comp. Mar. 30, 1959. 103p. Contract AT(30-3)-335. (ALI-C-61276). $2.50(OTS).

This compilation contains 202 abstracts of reports and documents on subjects related to maritime reactor safety; the abstracts are indexed in the AEC "Abstracts of Classified Reports" (ACR). These ACR references were listed as unclassified or declassified in TID-4021, TID-4035, and TID-4035, Supplement 1. The abstracts were selected as a part of the preparation of the classified bibliography (ALI-50, printed August 30, 1958) on this same subject. (See also SO-6200, September 15, 1957, unclassified.) The abstracts are grouped according to the category of information they present; within each category, the most recent abstracts are given first. Subject, author, and report number indices are provided. A report number code key is not included. The report numbers used by the AEC Technical Information Service can be found in TID-85 (1st Rev.). The abstracts are those indexed through ACR Vol. 13 (1957). Because of the lag in abstracting, reports issued in late 1957 are not likely to be included. (auth)

**11018** ANL-4739(Del.)
Argonne National Lab., Lemont, Ill.
FALL-OUT OF RADIOACTIVITY IN THE CHICAGO AREA DURING JANUARY, FEBRUARY, APRIL, AND MAY, 1951. PART I. RADIOCHEMICAL STUDIES. A. F. Stehney. PART II. RADIOAUTOGRAPHIC STUDIES. I. B. Berlman. Dec. 19, 1951. Decl. with deletions Apr. 22, 1959. 31p. Contract W-31-109-eng-38. $6.30 (ph), $3.00(mf) OTS.

Radioactivity from the Nevada tests was found in the air filter samples taken in the Chicago Area on January 29 and 30, 1951. The highest concentration of long-lived beta activity was 150 $\mu\mu c/m^3$; alpha activity was less than 0.1 $\mu\mu c/m^3$. Radiochemical analysis showed that the beta activities were fission products and $Np^{239}$. Since the natural radioactivity of radon and thoron and their short-lived daughters averages about 200 $\mu\mu c/m^3$ for either alpha or beta activity, dust from the tests increased the radioactivity of the air less than twofold. Snow collected in Chicago on February 5 contained 10 $\mu\mu c$ of beta activity per milliliter of melted snow. A small amount of fission product activity was also detected in air filter samples taken during the period of April 25 to May 7, 1951. The concentration of long-lived beta activity was less than 1 $\mu\mu c/m^3$. (auth)

**11019** BNL-116
Brookhaven National Lab., Upton, N. Y.
RADIOACTIVITY DETECTED IN PRECIPITATION AND SETTLED DUST, APRIL—MAY 1951. M. M. Weiss. 6p. $3.30(ph), $2.40(mf) OTS.

On April 10, 1951, a monitoring program was initiated for measuring radioactivity in precipitation and dust in the air. Sampling procedures are described. Results are summarized. Precipitation and settled dust yielded marked activity with peaks of activity which coincided with periods of precipitation. The variation in the decay times of the various samples indicated the absence of a homogeneous distribution of radioactive materials in the air and implies that each sample contains a different group of radioelements. Meteorological aspects of fall-out dispersal are discussed. (C.H.)

**11020** BNL-252
Brookhaven National Lab., Upton, N. Y.
A STUDY OF THE AIRBORNE RADIOACTIVITY AT BROOKHAVEN NATIONAL LABORATORY FROM THE NEVADA TESTS, MARCH THROUGH JUNE 1953.
Max M. Weiss. Nov. 1953. 18p. $3.30(ph), $2.40(mf) OTS.

Data on fall-out from the Nevada atomic tests from March through June 1953, based on samples collected in the environs of Brookhaven National Laboratory, are presented in tabular form. Methods of sample collection are described, and meteorological factors affecting fall-out in this area are discussed. (C.H.)

**11021** BNL-2643
Brookhaven National Lab., Upton, N. Y.
STUDY OF THE FALL-OUT IN THE GRAIN COLLECTED SEPTEMBER 22, 1954. M. M. Weiss. Nov. 9, 1954. Decl. Apr. 6, 1959. 9p. $1.80(ph), $1.80(mf) OTS.

An examination was made of rain water collected on the morning of Sept. 22, 1954, for the 24-hr period. Using analytical and graphic methods, the time of origin of the radioactivity was placed on Sept. 13, 1954. The contribution of fission products to the radioactivity and the accuracy of the time measurements are discussed. (C.H.)

**11022** CF-57-1-173
Oak Ridge National Lab., Tenn.
APPLIED HEALTH PHYSICS SEMI-ANNUAL REPORT [FOR] JULY 1956—DECEMBER 1956. 40p. Contract [W-7405-eng-26]. $6.30(ph), $3.00(mf) OTS.

Routine monitoring procedures are summarized. Based on samples collected by continuous air monitors, the weekly average value for air contamination in the laboratory area was $1.98 \times 10^{-12}$ $\mu c/cc$. Radioactive fall-out was determined by measuring the total activity and total number of particles collected on gum paper fall-out trays. Two peak periods of activity in July and September were concluded to be the result of weapons tests. Meteorological data are tabulated. Data are included from a survey of natural radioactive elements in TVA lake waters, activity levels in samples of river and lake waters in the laboratory drainage area, rain water, and laundry decontamination measurements. The combination film dosimeter-personnel identification badge was redesigned. A drawing of the badge and its component parts is included. Design modifications are described which were made in an automatic air sampler and in a hand and foot monitor. Results are summarized from radiation surveys. (C.H.)

**11023** CF-57-12-146
Oak Ridge National Lab., Tenn.
APPLIED HEALTH PHYSICS ANNUAL REPORT [FOR] JANUARY—DECEMBER 1957. 31p. Contract [W-7405-eng-26]. $6.30(ph), $3.00(mf) OTS.

Routine health physics monitoring activities for the period are reported. Data are tabulated on meteorological conditions and activity levels in air samples, river and lake bottom sediments, fall-out samples collected on gum paper, rain water, waste solutions, and biological samples. Data are included on activity discharged to waste settling basins, laundry decontamination measurements, and bio-assay doses. A survey of natural radioactive elements in TVA water was continued. Personnel monitoring data are tabulated. Results are summarized from radiation surveys in the reactor and pilot plant areas. Fall-out samples were examined for radioactive particles by autoradiography and for total beta activity by dry ashing and counting. Results are tabulated and examined for statistical significance. The high activity during the last half of the year was predominantly due to fall-out from continental weapons tests. Laboratory processes accounted for most of the high activity on the laboratory area during the last quarter of the year. (C.H.)

**11024** CF-58-4-6
Oak Ridge National Lab., Tenn.
GAMMA-RAY AND FAST-NEUTRON DOSE RATES IN AIR AS A FUNCTION OF DISTANCE FROM THE TSF REACTOR. F. N. Watson. Apr. 15, 1958. 5p. Contract [W-7405-eng-26]. $1.80(ph), $1.80(mf) OTS.

Measurements of the gamma-ray and fast-neutron dose rates in air were made at the Tower Shielding Facility for distances out to 4000 ft from the reactor. The reactor was shielded with 6 in. of water and was suspended at an altitude of 190 ft. Plots of the results are presented along with analytical expressions fitted to the curves. (auth)

**11025** CF-58-6-67
Oak Ridge National Lab., Tenn.
A GENERAL PURPOSE ALPHA-GAMMA HOT LABORATORY. H. M. Glen. June 17, 1958. 14p. Contract [W-7405-eng-26]. $3.30(ph), $2.40(mf) OTS.

The design of a general purpose hot laboratory that embodies the maximum permissible safety for operating personnel handling source material containing air-borne alpha-gamma emitters is described. Laboratory components such as the cell bank and supporting facilities are discussed. Floor plans are included. (J.R.D.)

**11026** CF-58-7-97
Oak Ridge National Lab., Tenn.
OZONE EXPLOSION IN IRRADIATED CRYOGENIC APPARATUS AND IMPLICATIONS UPON N. S. SAVANNAH GASEOUS WASTE DISPOSAL SYSTEM. William B. Cottrell. July 24, 1958. 9p. Contract [W-7405-eng-26]. $1.80(ph), $1.80(mf) OTS.

The several incidents of ozone explosions in cryogenic apparatus in radiation fields are reviewed. It is concluded that the explosions may be avoided if oxygen and/or ozone are excluded from the low-temperature regions where, in static systems, they tend to concentrate by liquefaction. Such provisions would make the proposed circulating $N_2$—cooled trap for the N. S. Savannah off-gas system acceptable if the initial oxygen content of the nitrogen coolant is less than 200 ppm. Higher concentrations are undoubtedly safe but the lack of information on such facets of the phenomena as quantities of ozone, required radiation exposure, and explosion-inciting agents does not permit a quantitative definition of the limiting conditions for an explosion. (auth)

**11027** CF-58-10-112
Oak Ridge National Lab., Tenn.
SAFETY REQUIREMENTS FOR THE DESIGN OF RADIOCHEMICAL PROCESSING FACILITIES. W. R. Winsbro, W. D. Burch, and A. D. Ryon. Oct. 15, 1958. 15p. Contract [W-7405-eng-26]. $3.30(ph), $2.40(mf) OTS.

Safety requirements to be used in establishing standardized safety practices and procedures for engineering design of radiochemical processing facilities are presented. Revision and expansion of future issues are planned. (J.R.D.)

**11028** CML-M-124-6
Chicago. Univ. Chicago Midway Labs.
HIGH-ALTITUDE SAMPLING TECHNIQUES. Progress Report No. 6 [for] February 1959. Henry Halle. 15p. Contract AT(11-1)-308. $3.30(ph), $2.40(mf) OTS. (CML-SR-M-124-6).

The fourth balloon flight to an altitude of 60,000 feet to collect stratospheric air samples for radiation analysis is described. Equipment which is to be employed during future flights to recover stratospheric water, carbon dioxide, and solid particulates is described. (W.L.H.)

**11029** DP-341
Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.
GEOLOGY AND HYDROLOGY FOR DISPOSAL OF RADIOACTIVE WASTES TO GROUND AT THE SAVANNAH RIVER PLANT. Stanley O. Reichert. Dec. 1958. 24p. Contract AT(07-2)-1. $1.00(OTS).

Data obtained from monitoring wells show that seepage basins are effectively percolating and decontaminating large volumes of low level radioactive liquids at the Savannah River Plant. Stratigraphic panel diagrams and hydrologic maps give a good picture of the factors that are important in evaluating the performance of seepage basins and burial pits. A general method is outlined for determining the proper placement of a seepage basin or burial ground area and for evaluating and monitoring its performance. (auth)

**11030** GAT-T-655
Goodyear Atomic Corp., Portsmouth, Ohio.
UNCLASSIFIED SUMMARY OF SAFETY AND HEALTH PHYSICS PROGRESS REPORTS (FROM FOURTH QUARTER FY-1955 TO SECOND QUARTER FY-1959). Apr. 15, 1959. 153p. Contract AT(33-2)-1. $24.30 (ph), $7.50(mf) OTS.

Safety and health physics activities during the period are summarized. Data are tabulated on injury and property damage, personnel monitoring, radioactivity levels in samples of air, river water, and stream bottom sediments, and the fluoride concentration in samples of air and vegetation. (C.H.)

**11031** HASL-5
New York Operations Office. Health and Safety Lab., AEC.
STRONTIUM PROGRAM SUMMARY REPORT FOR NOVEMBER 1957. Edward P. Hardy, Jr. 72p. $12.30 (ph), $4.50(mf) OTS.

Strontium-90 levels in fall-out collected in New York City, Pittsburgh, Chicago, other U. S. sites, and sites outside the U. S., milk from New York, canned fish, and New York City tap water are summarized for data available up to Oct. 30, 1957. (W.D.M.)

**11032** HASL-10
New York Operations Office. Health and Safety Lab., AEC.
STRONTIUM PROGRAM. Summary Report for January 1958. Edward P. Hardy, Jr. 73p. $12.30(ph), $4.50 (mf) OTS.

Strontium-90 levels in fall-out from New York City, Pittsburgh, Chicago, other U. S. sites, and sites outside the U. S., in milk (powdered and liquid), and in New York City tap water are summarized for data available up to December 30, 1957. (W.D.M.)

**11033** HASL-38
New York Operations Office. Health and Safety Lab., AEC.
STRONTIUM PROGRAM. Summary Report for May 1958. Edward P. Hardy, Jr. May 16, 1958. 82p. $13.80(ph), $4.80(mf) OTS.

The status of the Strontium Program as of May 1958 is reviewed. Original data for April 1958 are appended. Samples of rain water, river water, municipal water supplies, snow, fresh milk, and powdered milk collected at stations throughout the continental United States and at selected sites throughout the world were analyzed for total beta activity, strontium-89, and strontium-90 levels. Data are tabulated on strontium-90 levels in samples collected in New York, Illinois, Alabama, Utah, South Dakota, California, Florida, Washington, Pennsylvania, New Jersey, Oklahoma, Connecticut, and sites outside the continental United States. (C.H.)

**11034** HASL-47
New York Operations Office. Health and Safety Lab., AEC.
STRONTIUM PROGRAM SUMMARY REPORT FOR JUNE AND JULY 1958. Edward P. Hardy, Jr. Aug. 1, 1958. 88p. $13.80(ph), $4.80(mf) OTS.

Strontium-90 levels in fall-out collected at New York City, Pittsburgh, Chicago, Westwood, N. J., Richmond, Calif., and other U. S. and foreign sites, in milk from New York, and in New York City tap water are summarized for data available up to July 28, 1958. (W.D.M.)

**11035** HW-7920
[Hanford Works, Richland, Wash.].
ACTION TAKEN ON THE SPOT CONTAMINATION IN THE SEPARATIONS PLANT AREAS. H. M. Parker. Oct. 30, 1947. Decl. Feb. 15, 1956. 6p. Contract [W-31-109-Eng-52]. $1.80(ph), $1.80(mf) OTS.

Surveys of ground contamination in the T and B plant areas at Hanford revealed the presence of many small radioactive spots on the ground. The segregated particles had an average mass of 1 mg and an activity range of approximately 0.1 to 1.0 μc. Results of chemical, radiochemical, and spectrographic analysis are given. (W.D.M.)

**11036** HW-23517
Hanford Works, Richland, Wash.
A REPORT OF PARTICLE CONTAMINATION, OCTOBER—DECEMBER 1951. H. J. Paas and C. W. Thomas. Feb. 15, 1952. Decl. Apr. 24, 1959. 34p. Contract W-31-109-Eng-52. $6.30(ph), $3.00(mf) OTS.

The number of radioactive particles was determined in samples of air collected between October and December 1951 at the Hanford Works and at several remote locations in the Pacific Northwest. Radioautographs were made of air filter samples. Results showed excessive particle concentrations immediately following each of the Nevada nuclear explosions during Operation Buster-Jangle. In addition, a significant increase in particulate contamination was observed during the period from October 2 through October 11, which was prior to the first Nevada explosion. This increase was associated with a nuclear explosion from sources other than the Nevada tests or the Hanford Works. Data obtained during Operation Buster-Jangle are summarized. (C.H.)

**11037** HW-28925
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
RADIOACTIVE PARTICLE FALLOUT IN THE HANFORD ENVIRONS FROM NEVADA NUCLEAR EXPLOSIONS, SPRING, 1953. H. J. Paas, F. E. Adley, P. L. Eisenacher, D. L. Reid, J. J. Fuquay, and D. E. Jenne. Aug. 4, 1953. Decl. Apr. 28, 1959. 52p. Contract W-31-109-Eng-52. $9.30(ph), $3.60(mf) OTS.

Various organizations in the Biophysics Section of the Radiological Sciences Department participated in evaluating local radioactive particle fall-out as influenced by the nuclear explosions at the Nevada Proving Grounds during the early part of 1953. Data collected from approximately 50 air monitoring stations operated by the Regional Survey forces were used to determine the trend of radioactive particle concentrations in the atmosphere between March and June. These measurements were supplemented with the findings of associated organizations in the Biophysics Section during and immediately after the peak influx on May 26. This publication summarizes the results obtained from these measurements. (auth)

**11038** HW-54243(Rev.)
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
THE HANFORD ATOMIC PROJECT AND COLUMBIA RIVER POLLUTION. H. V. Clukey. Dec. 20, 1957. 21p. Contract [W-31-109-Eng-52]. $4.80(ph), $2.70 (mf) OTS.

Since the initial operation of the Hanford reactors in 1944, the radioactive material released to the Columbia River in reactor cooling water effluent has shown a general increase. Radioactive materials released to the Columbia River in 1957 averaged in the range of a few per cent of the maximum permissible concentrations, and probably contributed less than 10% of the maximum permissible exposure to individuals living in the environs of the plant. Heat released to the Columbia River by the Hanford reactors is considered to be minor with respect to deleterious effects on fish. Of the chemicals released to the environs by the Hanford plants, only hexavalent chromium is of significant concentration in the Columbia River, and this was below the recommended limit of 0.02 ppm for Columbia River fish. Results of biological field studies indicate no detrimental effects on biota of the Columbia River because of Hanford effluents. Biological pollution from the Hanford project was found to be adequately controlled by proper disposal or treatment before sewage liquors reach the Columbia River. (C.H.)

**11039** ITR-1513(Del.)
Sandia Corp., Albuquerque, N. Mex.
SURFACE ALPHA MONITORING AS A METHOD OF MEASURING PLUTONIUM FALLOUT. Test Group 57, Program 74 [of] OPERATION PLUMBBOB. R. E. Butler. May 1957. Decl. with deletions Apr. 27, 1959. 110p. $18.30(ph), $6.00(mf) OTS.

A correlation, as determined by chemical analysis of fall-out, is given between alpha survey meter readings of typical concrete surfaces and plutonium concentration in the immediate area. The training of personnel in the determination of radiation hazards following accidental one-point detonation of a weapon containing plutonium is described. Maps of the test area show monitoring results, as well as isoconcentration contours. Since chemical analysis is not immediately available, conversion of counting data to plutonium concentrations is estimated. (auth)

**11040** KAPL-1409
Knolls Atomic Power Lab., Schenectady, N. Y.
RADIOLOGICAL DEVELOPMENT ACTIVITIES IN THE HEALTH PHYSICS UNIT. Semiannual Progress Report [for] January—June 1955. L. J. Cherubin and J. J. Fitzgerald. 49p. Contract W-31-109-Eng-52. $4.80 (ph), $2.70(mf) OTS.

Data are presented from studies on the efficiencies of filter materials, an evaluation of portable air samplers, the calibration of instruments for $\beta$ monitoring, the preparation of scintillation crystals for fast neutron monitoring, investigations of neutron foil dosimetry and neutron effects on silver shielded x-ray film, the radiochemical analysis of liquid waste for $Y^{90}$ concentration, the development of a method for the determination of the $Na^{24}$ content of urine, and the development of improved methods for the preparation of samples of vegetation for radiometric analysis. Radiobiological monitoring of the Mohawk River was initiated to evaluate the effects of disposal of radioactive liquid waste into that stream. Data are tabulated on the radioactivity concentrations in plants and animals collected from the river. New formulas are developed for calculating the potential hazards associated with the dispersal of radioactive materials following a nuclear incident. (C.H.)

**11041** KIR-206/58
Norway. Forsvarets Forskningsinstitutt, Oslo.
RADIOCHEMICAL ANALYSIS OF FALLOUT IN NORWAY. Communication No. 7. H. Bergh, G. Finstad, L. Lund, O. Michelsen, and B. Ottar. June 1958. 7p.

Data are tabulated on the levels of strontium-89, strontium-90, and cesium-137 found in samples of rain water, drinking water, and milk collected in Norway between November 1957 and April 1958. (C.H.)

**11042** LA-1597
Los Alamos Scientific Lab., N. Mex.
MONITORING OF COW'S MILK FOR FRESH FISSION PRODUCTS FOLLOWING AN ATOMIC DETONATION. William S. Johnson, Jean McClelland, and Clarence P. Skillern. Oct. 1953. 13p. Contract W-7405-eng-36. $3.30(ph), $2.40(mf) OTS.

Milk samples were collected on an approximately daily basis from various points both in and out of the fall-out pattern resulting from Shot Harry, Upshot-Knothole Operation, detonated on 19 May 1953. Sample collection was limited generally to the purchase of bottled or packaged milk from the retail market. An analytical procedure with good recoveries was developed to determine the activity in the milk. The concentrations found, when compared to an emergency tolerance value for water, do not represent in themselves a source of internal hazard. The data presented tend to indicate that the principal source of contamination was from material ingested by the animals. (auth)

**11043** LA-1685
Los Alamos Scientific Lab., N. Mex.
SOME OBSERVATIONS ON AIR SAMPLING TECHNIQUES USED AT THE NEVADA PROVING GROUND. C. P. Skillern, W. S. Johnson, and H. F. Schulte. June 1954. Changed from OFFICIAL USE ONLY Oct. 5, 1956. 54p. Contract W-7405-eng-36. $9.30(ph), $3.60(mf) OTS.

The development of sampling methods and some field results of the off-site air sampling stations at the Nevada Proving Ground are reviewed. A technique of radioautography is presented which yields information about the activities of individual fall-out particles. This technique gives a comparison of particle activities from air drops and tower shots and a reason for the greater contamination associated with the latter. It also indicates that air samplers do not capture the most active fall-out particles, presumably because of their large size. (auth)

**11044** LAMS-1945
Los Alamos Scientific Lab., N. Mex.
FALL-OUT STUDIES WITH A LABORATORY CONTROLLED MODEL. Ford Kalil. Aug. 1955. 75p. Contract W-7405-eng-36. $9.30(ph), $3.60(mf) OTS.

To seek information for a better understanding of the phenomena involved in fall-out, a fireball effect was simulated in a small closed room by subjecting various materials to a high-current (~360 amp) arc produced between graphite electrodes, the anode being impregnated with radioactive materials. The time duration of the arc, power dissipated, and distance from the samples were controlled. The radioactivity which remained airborne, which settled out onto the floor and its distribution, and which deposited on the test material was measured, and percentages of the total measured activity were determined. The results were as follows: the airborne activity tended to be larger when the test material vaporized more readily than when it popcorned and/or fused; more activity tended to settle out onto the floor as the popcorning increased; and more activity tended to be deposited on the test sample as the fusion of the sample increased. It is not known how the introduction of a blast wave might affect the results. Further investigation is warranted in which the blast effect may be studied independently, and perhaps also in conjunction with the arc, to gain a more complete picture of the fall-out mechanism. (auth)

**11045** LAMS-2031
Los Alamos Scientific Lab., N. Mex.
AIR, PRECIPITATION, AND SURFACE CONTAMINATION AT CERTAIN LOCALITIES IN NEW MEXICO FROM OPERATION TEAPOT, SPRING 1955. William S. Johnson. Apr. 24, 1956. 26p. Contract W-7405-eng-36. $4.80(ph), $2.70(mf) OTS.

Air sampling stations were activated at the Los Alamos Scientific Laboratory and at Albuquerque, New Mexico, immediately following the Wasp detonation of Operation Teapot, February 18, 1955. A background monitor was operated at Sante Fe during part of Operation Teapot. Filter paper samples were counted directly for beta activity in a methane-flow proportional scaler. Selected samples were retained for further counting to determine decay rates. This program was supplemented with ground monitoring and precipitation analysis. Data are tabulated and presented graphically. (C.H.)

**11046** M-5949

Chicago. Univ. Enrico Fermi Inst. for Nuclear Studies.

PROJECT SUNSHINE BULLETIN NUMBER 11. Dec. 1, 1955. Decl. Apr. 29, 1959. 63p. $10.80(ph), $3.90 (mf) OTS.

Data are summarized from measurements of strontium-90 concentration in samples collected at various stations throughout the world. Data are included for activity found in human bone and teeth, animal bone, cheese, milk, fish, eggs, vegetation, soil, rain water, snow, sea water, and air samples. Data for all biological samples are presented in units of 1/1000 of the tolerance dose of strontium-90 for an average man of 1000 grams total-body concentration of calcium. Thus, the Sunshine Unit is 1/1000 microcuries of strontium-90 per 1000 grams calcium or 2.2 disintegrations per minute of strontium-90 per gram of calcium. Results for water samples are reported in disintegrations per minute of strontium-90 per unit volume. Air concentration data are given in disintegrations per minute per $10^6$ cubic feet of air. (C.H.)

**11047** M-7000

[Brookhaven National Lab., Upton, N. Y.]

1958 PANEL STUDIES. J. Weiss and F. P. Cowan. Mar. 5, 1959. 4p. $1.80(ph), $1.80(mf) OTS.

During the summer of 1958 measurements on the accumulation of fall-out on typical materials of construction were continued. The equipment and methods were identical with those used in 1957 which were described in BNL-497. (W.D.M.)

**11048** M-7003

Nevada Test Organization. Off-Site Radiological Safety Activities, AEC.

REPORT OF OFF-SITE RADIOLOGICAL SAFETY ACTIVITIES FOR PROJECT 57, NEVADA TEST SITE, APRIL 1957. O. R. Placak, M. W. Carter, and R. A. Gilmore. 18p. $4.80(ph), $2.70(mf) OTS.

High-volume air sampling stations were established at various populated off-site locations around the Nevada Test Site during weapons safety tests in 1957. Monitors were set up at various selected sites. Fall-out trays were used on a small scale. A map showing air sampling locations is included. Data are tabulated showing air sampling results, accumulated air concentrations, fall-out tray results, and water sample results. Some fall-out was detected in the off-site area. However, the accumulated alpha activity in the air was well below the operational guide of 400. (C.H.)

**11049** M-7004

[Nevada Test Organization. Off-Site Radiological Safety Activities, AEC.]

REPORT OF OFF-SITE RADIOLOGICAL SAFETY ACTIVITIES FOR PROJECT 58, NEVADA TEST SITE, DECEMBER 1957. O. R. Placak, M. W. Carter, and R. A. Gilmore. 17p. $3.30(ph), $2.40(mf) OTS.

High-volume air sampling stations were set up off-site during atomic weapons safety tests at the Nevada Test Site in December 1957. Data are tabulated on the alpha and beta activity in air samples. The accumulated alpha air concentrations for inhabited locations was calculated, and data are tabulated. The alpha activity was well below the operational guide level established by the Division of Biology and Medicine, Atomic Energy Commission. The beta activity was of the order of one hundred times background. (C.H.)

**11050** M-7005

[Nevada Test Organization. Off-Site Radiological Safety Activities, AEC].

REPORT OF OFF-SITE RADIOLOGICAL SAFETY ACTIVITIES FOR PROJECT 58-A, NEVADA TEST SITE, FEBRUARY—MARCH 1958. O. R. Placak, M. W. Carter, and R. A. Gilmore. 9p. $1.80(ph), $1.80(mf) OTS.

The off-site radiological safety activities for Project 58-A consisted of establishing high-volume air samplers at various populated locations around the Nevada Test Site and of having personnel available to dispatch to any area in which fall-out might occur. The methods and procedures utilized for this project were similar to those employed in Projects 56, 57, and 58. (W.D.M.)

**11051** M-7067

New York Operations Office. Health and Safety Lab., AEC.

PACIFIC SEA WATER SAMPLES. June 1, 1958. 101p. $15.30(ph), $5.40(mf) OTS.

Tabular data are presented on the radioactivity in samples of sea water collected throughout the Pacific Ocean during 1956, 1957, and 1958. (W.D.M.)

**11052** M-7081(Del.)

Division of Biology and Medicine, AEC.

AN ESTIMATE OF NEUTRON-INDUCED RADIOACTIVITY IN SOIL FROM WEAPON DETONATIONS. Alfred W. Klement, Jr. May 15, 1958. Decl. with deletions Apr. 22, 1959. 4p. $1.80(ph), $1.80(mf) OTS.

An estimate is presented which is intended to establish an expected order of magnitude of resulting thermal neutron-induced activity and relative production of stable and radioactive isotopes in soil. The estimate is based on a one MT weapon (100%) fusion detonated at the surface of Nevada Test Site soil. (W.D.M.)

**11053** M-7086

New York Shipbuilding Corp., Camden, N. J.

ENVIRONMENTAL RADIOACTIVITY SURVEY. Laboratory Summaries 1-3 [for] August 1958 through March 1959. C. W. Myers, H. W. Locke, H. L Kraig, and W. Possi. 6p. $1.80(ph), $1.80(mf) OTS.

Environmental radioactivity surveys from Aug. 1958 to March 1959 were made by New York Shipbuilding Corporation from water, air, and surface samples. Sampling methods are discussed and results are given. (W.D.M.)

**11054** M-7140

Los Alamos Scientific Lab., New Mex.

MECHANISMS OF FRACTIONATION. J. L. Magee. Nov. 16, 1953. Decl. Nov. 7, 1958. 15p. Contract [W-7405-eng-36]. $3.30(ph), $2.40(mf) OTS.

The mechanisms involved in fractionation as measured in samples obtained early from drone planes during the cloud rise or from manned aircraft a few hours later are discussed. A key problem in fractionation is the formation of the precipitate in the cloud, and an attempt is made to describe this mechanism. (W.D.M.)

**11055** NARF-59-1T

Convair, Fort Worth, Tex.

HEALTH PHYSICS ACTIVITIES [FOR] OCTOBER 1, 1956 TO SEPTEMBER 30, 1958. R. F. Shockley and W. R. Miller, comps. and eds. Jan. 1959. 139p. (3-R-81).

Data are tabulated on the radioactivity in samples of surface water, rain water, surface soil, subsurface soil, vegetation, and air collected in the Fort Worth area during 1955 through 1958. All peaks in activity were related to nuclear weapons testing. The over-all picture of Health Physics activities during the past two years are reviewed. Routine and special monitoring and safety procedures are discussed. (C.H.)

**11056** NP-7364
Australia. Commonwealth X-Ray and Radium Lab., Melbourne.
RADIOACTIVE CONTAMINATION FROM NUCLEAR TESTS AND REACTORS, WITH PARTICULAR APPLICATION TO AGRICULTURE AND FISHERIES. Library Information Bulletin No. 44. Mar. 1959. 9p.

A list is presented of 94 references on the subject of radioactive contamination from nuclear tests and reactors, with particular application to agriculture and fisheries. (C.H.)

**11057** NYO-1576(Del.)
New York Operations Office. Health and Safety Div., AEC.
RADIOACTIVE DEBRIS FROM OPERATIONS BUSTER AND JANGLE. OBSERVATIONS BEYOND 200 MILES FROM THE TEST SITE. Jan. 28, 1952. Decl. with deletions Apr. 22, 1959. 112p. $18.30(ph), $6.00(mf) OTS.

A network of 50 stations located at weather bureau installations collected daily samples of settled and airborne dust in the area beyond 200 mi from the test site of operations BUSTER and JANGLE. This network was augmented by mobile teams operating immediately beneath the trajectories of the radioactive clouds and by aerial collections made along the 85th and 95th meridians. Data collected by the Weather Bureau stations were reported daily and cumulatively. Data are presented extrapolated to Feb. 1, 1952. The collection of background data prior to the initial test of the BUSTER series was hampered due to two atomic explosions in a foreign country just prior to the start of this program. Particle size determinations by two independent methods revealed that substantially all the activity was contained within the range of respirable particle sizes. (C.H.)

**11058** NYO-4505(Del.)
New York Operations Office. Health and Safety Div., AEC.
RADIOACTIVE DEBRIS FROM OPERATIONS TUMBLER AND SNAPPER. OBSERVATIONS BEYOND 200 MILES FROM THE TEST SITE. PART I. Jan. 12, 1953. Decl. with deletions Apr. 22, 1959. 63p. $10.80(ph), $3.90(mf) OTS.

NYO-4512(Del.) issued as unclassified version of Part II.

During the spring 1952 atomic weapons tests a nationwide network of weather stations, supplemented by 16 foreign stations, collected samples of settled and airborne dust which were counted radiologically. The data are reported as bases for estimating possible health hazards. (W.D.M.)

**11059** NYO-4512(Del.)
Weather Bureau, Washington, D. C.
RADIOACTIVE DEBRIS FROM OPERATIONS TUMBLER AND SNAPPER. OBSERVATIONS BEYOND 200 MILES FROM THE TEST SITE. PART II. Robert J. List. Feb. 25, 1953. Decl. with deletions Apr. 22, 1959. 145p. $24.30(ph), $7.50(mf) OTS.

NYO-4505(Del.) issued as unclassified version of Part I.

The results of the fall-out monitoring program at fixed stations more than 200 miles from the test site following the series of atomic tests in Nevada during the spring of 1952 are shown in a series of maps. Trajectories of debris from the individual bursts are given, together with a discussion of meteorological phenomena associated with the transport of atomic debris. (W.D.M.)

**11060** NYO-4552(Del.)
New York Operations Office. Health and Safety Lab., AEC.
RADIOACTIVE DEBRIS FROM OPERATIONS UPSHOT AND KNOTHOLE. June 25, 1954. Decl. with deletions Apr. 22, 1959. 63p. $13.80(ph), $4.80(mf) OTS.

Activities of the National Monitoring System are summarized for the period March 1 to June 15, 1953, during which eleven nuclear devices were fired at the Nevada Proving Grounds during Operation Upshot-Knothole. The program employed a world-wide network of 125 sampling locations. Each station collected samples of atmospheric dusts for radiometric analysis. A comparison is made of air concentrations and fall-out activities. Data are tabulated. (C.H.)

**11061** NYO-4555(Del.)
Weather Bureau, Washington, D. C.
A METEOROLOGICAL ANALYSIS OF THE TRANSPORT OF DEBRIS FROM OPERATION IVY. Lester F. Hubert, Lester Machta, and Robert J. List. Oct. 30, 1953. Decl. with deletions Apr. 22, 1959. 138p. $24.30(ph), $7.50(mf) OTS.

An analysis of the meteorological aspects of Operation Ivy is presented, and the radiological data are documented. Fall-out data were collected on a world-wide network of gummed paper stations, supplemented by a few air filters. Documentation of the data is in the form of maps showing the daily collections of beta activity at every sampling station used during this operation. The effects of transport and diffusion are discussed. (W.D.M.)

**11062** NYO-4602(Del.)
Weather Bureau, Washington, D. C.
THE TRANSPORT OF ATOMIC DEBRIS FROM OPERATION UPSHOT-KNOTHOLE. Robert J. List. June 25, 1954. Decl. with deletions Apr. 22, 1959. 192p. $30.30(ph), $8.70(mf) OTS.

In connection with the Upshot-Knothole test series in Nevada in the spring of 1953, a gummed film monitoring network consisting of 95 U. S. and 26 foreign stations was set up. Of the 11 devices detonated, ranging in yield from 0.2 to 60 kt, higher activity was found for tower bursts than from air drops. Information relating to the optimum spacing of stations in a gummed film network and the possibility of missing local areas of intense fall-out are discussed. (W.D.M.)

**11063** NYO-4621(Del.)
New York Operations Office. Health and Safety Lab., AEC.
RADIOACTIVE DEBRIS FROM OPERATION CASTLE: WORLDWIDE FALLOUT. D. E. Lynch. Jan. 21, 1955. Decl. with deletions Apr. 22, 1959. 38p. $6.30(ph), $3.00(mf) OTS.

Data on worldwide fall-out of radioactive debris from the Castle series of weapons tests conducted in the Spring of 1954 are summarized. Total world fall-out of Beta activity to August 31, excluding the vicinity of the test site, is estimated at 7.1 megacuries, extrapolated to 1/1/55. During March, April and May the average monthly fall-out was 1.5 megacuries. During June and

July it was at about half this level but in August it increased to 1.2 megacuries. (auth)

**11064** NYO-4627
New York Operations Office. Health and Safety Lab., AEC and Woods Hole Oceanographic Institution, Mass.
ANALYSIS OF DATA OBTAINED BY JAPANESE SCIENTISTS DURING THE CRUISE OF THE SHUNKOTSU MARU. Allyn C. Vine. Mar. 28, 1955. Decl. Apr. 22, 1959. 28p. $6.30(ph), $3.00(mf) OTS.

In June 1954 the Japanese made a comprehensive series of surface and depth measurements of the radioactivity in the Marshalls and Marianas. These measurements were at ranges up to 900 miles and decay times up to 6 to 15 weeks. Plots of the original data are shown. A few conclusions and recommendations are made. Estimates of the present strength and location of the radioactivity are presented. (auth)

**11065** NYO-4645(Del. 2)
Weather Bureau, Washington, D. C.
WORLD-WIDE FALLOUT FROM OPERATION CASTLE. Robert J. List. May 17, 1955. Decl. with deletions Apr. 28, 1959. 226p. $36.30(ph), $10.20(mf) OTS).

A world-wide network of gummed film stations was established to monitor fall-out following Operation Castle. Although meteorological data were poor, a general connection of tropospheric flow patterns with observed fall-out was evident. There was a tendency for debris to remain in tropical latitudes, with incursions into the temperate regions associated with meteorological disturbances of the predominantly zonal flow. As the season advanced, such incursions became more evident. Outside of the tropics, the southwestern United States received the greatest total fall-out, about five times that received in Japan. The maximum fall-out on any day at an individual station in the United States, corrected to sampling day, was 200,000 d/m/ft$^2$. It is concluded that the probability of early fall-out in inhabited regions would be reduced by holding Pacific test series in the winter months. (auth)

**11066** ORNL-283
Oak Ridge National Lab., Tenn.
PARTICULATE AIR CONTAMINATION AT ORNL. J. S. Cheka and H. J. McAlduff. June 30, 1949. Decl. Dec. 8, 1955. 68p. Contract W-7405-eng-26. $12.30 (ph), $4.50(mf) OTS.

Late in May 1948 during the course of routine surveys localized radiation was detected at three different locations outside of the restricted area. In each the radiation was found to emanate from a single particle. The particles were checked for size, $\alpha$ activity, $\beta$ activity, $\gamma$ activity, decay rate, and spectrographically for chemical constituents. Sizes of the isolated particles ranged from $\sim$80 to 400$\mu$ in diameter. (W.D.M.)

**11067** TID-3528
Technical Information Service, AEC.
RADIOACTIVE FALLOUT. A Literature Search. William E. Bost, Sidney F. Lanier, Raymond L. Scott, and Hugh E. Voress, comps. Apr. 1959. 43p. $1.00 (OTS).

A list is presented of 514 references on the dispersal and fall-out of radioactive debris from nuclear explosions. References on the metabolism and toxicology of fission products and monitoring instruments and techniques are included. (C.H.)

**11068** UCLA-32
California. Univ., Los Angeles. Atomic Energy Project.
THE 1948 RADIOLOGICAL AND BIOLOGICAL SURVEY OF AREAS IN NEW MEXICO AFFECTED BY THE FIRST ATOMIC BOMB DETONATION. PARTS I AND II. Stafford L. Warren. Oct. 12, 1949. Decl. Apr. 27, 1959. 99p., 2 illus. Contract AT-04-1-GEN-12. $25.80(ph), $7.80(mf) OTS.

Details of survey of remaining radioactivity due to fall-out from first atomic bomb include study of soil profiles, techniques and counting equipment used, animal investigations with data on external evidence of radiation damage, ecological aspects of survey and radiological assay of animal samples, maps, and photographs. (W.D.M.)

**11069** UCLA-140
California. Univ., Los Angeles. Atomic Energy Project.
THE 1949 AND 1950 RADIOLOGICAL SOIL SURVEY OF FISSION PRODUCT CONTAMINATION AND SOME SOIL-PLANT INTERRELATIONSHIPS OF AREAS IN NEW MEXICO AFFECTED BY THE FIRST ATOMIC BOMB DETONATION. K. H. Larson, J. H. Olafson, J. W. Neel, W. F. Dunn, S. H. Gordon, and B. Gillooly. May 31, 1951. Decl. Jan. 26, 1956. 83p. Contract AT-04-1-GEN-12. $15.30(ph), $5.40(mf) OTS.

This report summarizes the results of the radiological surveys and assay of soils and plants collected during the Biological Field Surveys of 1949 and 1950 from the areas contaminated by the fall-out from the first atomic bomb detonation in New Mexico. (C.H.)

**11070** UCLA-145
California. Univ., Los Angeles. Atomic Energy Project.
CONTINUOUS RADIOACTIVITY MONITORING OF THE ATMOSPHERE AT THE ATOMIC ENERGY PROJECT, UNIVERSITY OF CALIFORNIA AT LOS ANGELES. PART I. THE PERIOD AFTER THE NEVADA TESTS. Leonard Baurmash, W. R. Kennedy, and G. Streit. July 17, 1951. Decl. Mar. 6, 1957. 14p. Contract AT-04-1-GEN-12. $3.30(ph), $2.40(mf) OTS.

A determination of the $\beta$-$\gamma$ and $\alpha$ background in the Los Angeles area has been made. The $\beta$-$\gamma$ background is telemetered to the Atomic Energy Project at UCLA while weekly dust samples are counted for the $\alpha$ contamination. The presence of increased quantities of contamination after the recent Las Vegas tests has been indicated by several rises in the $\beta$-$\gamma$ and $\alpha$ background. These rises may be correlated with wind information which indicate the possibility of this material being carried by the winds from over the test area to this region. (auth)

**11071** UCLA-162
California. Univ., Los Angeles. Atomic Energy Project.
CONTINUOUS RADIOACTIVITY MONITORING OF THE ATMOSPHERE AT THE ATOMIC ENERGY PROJECT, UNIVERSITY OF CALIFORNIA AT LOS ANGELES. PART II. THE PERIOD AFTER THE GREENHOUSE TESTS. Leonard Baurmash and W. R. Kennedy. Oct. 23, 1951. Decl. Jan. 13, 1956. 9p. Contract AT-04-1-GEN-12. $1.80(ph), $1.80(mf) OTS.

The alpha and beta-gamma background in Los Angeles is being continuously monitored in order to determine increases in background due to various reasons. The presence of increased quantities of contamination after the Greenhouse tests is not as readily noticeable as after the Las Vegas tests. However, there are several increases in background. There does not appear to be any correlation between the increases in alpha background and the beta-gamma background. (auth)

**11072** USNRDL-TR-265
Naval Radiological Defense Lab., San Francisco.
REFLECTANCE CHARACTERISTICS OF NEVADA TEST SITE SOILS. R. W. Hillendahl. May 6, 1958. 19p. (AFSWP-1081).

The spectral and spatial reflectance properties of four samples of Nevada Test Site soils are described. Spectral measurements were made on a variety of instruments in the laboratory. All samples showed the same trend of increased reflectance with increasing wavelength, but the value of reflectance at any one wavelength varied considerably among the samples. A correlation was found between reflectance and geographical location in the test area. The spatial reflectance of all samples was near enough to that of a Lambert reflector to use this approximation in calculations. The albedo of the soils was measured directly using bomb light and was found to be in good agreement with albedos computed from spectral reflectance and spectral distribution of bomb light. (auth)

**11073** UWFL-11
Washington. Univ., Seattle. Applied Fisheries Lab.
CONCENTRATION OF ACTIVE MATERIALS BY HYDROIDS IN THE BIKINI LAGOON DURING THE SUMMER OF 1947. Lauren R. Donaldson, Allyn H. Seymour, Arthur D. Welander, and Kelshaw Bonham. Decl. Mar. 5, 1957. 9p. Contract W-28-094-eng-33. $1.80(ph), $1.80(mf) OTS.

The fouling growth on a boat frame that had been moored in Bikini Lagoon from July 15 to Aug. 28, 1947, was counted for activity. This material, composed mostly of a hydroid belonging to the family Plumularidae, had concentrated active materials exceeding the activity found in the water many times. (W.D.M.)

**11074** UWFL-16
Washington. Univ., Seattle. Applied Fisheries Lab.
BIKINI RADIOBIOLOGICAL RESURVEY OF 1948. Decl. Mar. 5, 1957. 51p. Contract W-28-094-eng-33. $9.30 (ph), $3.60(mf) OTS.

During the 18 days at Bikini samples of the faunal and floral systems were collected from the lagoon, the inner and outer reefs, and from the islands. A total of 1918 ashed samples were prepared for determination of the contained radioactive materials. A survey was completed of the major islands to determine the amount of contamination with radioactive debris and drift material. Field counts were also made of the extent of contamination of the land masses, land plants and animals, etc., from the contamination of fission products found in the Lagoon. (W.D.M.)

**11075** WAPD-CTA-TH-195
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
PWR PREOPERATIONAL RADIATION MONITORING SURVEY. Quarterly Report [for] Third Quarter, 1957 (July, August, September 1957). 19p. $3.30(ph), $2.40 (mf) OTS.

Results are summarized on the radioactivity found in samples of vegetation, soil, river water, algae, river mud, and air collected from the vicinity of the Pressurized Water Reactor site. Data on fall-out activity during the period are tabulated. (C.H.)

**11076** WT-649
California. Univ., Livermore. Radiation Lab.
FALL-OUT GAMMA RAY INTENSITY. Melvin P. Klein. Jan. 1958. 13p. Project 5.3 [of] OPERATION IVY. $3.30(ph), $2.40(mf) OTS.

Originally issued as UCRL-5125.

Measurements of the intensity of fall-out gamma radiation as a function of time and distance from the Ivy, Mike, and King shots are reported. Instruments were placed around Eniwetok Atoll and at several atolls in a southerly semicircle with respect to Eniwetok. Contrary to expectations the winds prevailing at the time of the Mike shot were south or southeasterly, and no fall-out gamma radiation with the limits of detectability was measured at any location other than Eniwetok. The gamma radiation measured on Eniwetok Atoll was considered normal fission fragment radiation which decayed with a $t^{-1.2}$ characteristic. (auth)

**11077** WT-802(Del.)
California. Univ., Los Angeles. Atomic Energy Project.
COMPARISON AND EVALUATION OF DOSIMETRY METHODS APPLICABLE TO GAMMA RADIATION. George V. Taplin, Sanford C. Sigoloff, Clayton H. Douglas, Donald E. Paglia, Charles J. Heller, and Donald F. Wales. Sept. 1953. Decl. with deletions Apr. 22, 1959. 63p. $10.80(ph), $3.90(mf) OTS.

The accuracy and practicality are evaluated and compared of chemical vs. film and other methods of gamma dosimetry for radiations encountered under bomb conditions at sites receiving either prompt or residual gamma exposures or mixtures of both, only residual-gamma radiations, either neutron induced or from fission product fall-out, and mixed neutron-gamma irradiation plus correlation with biological effects. The results from testing approximately 15,000 dosimeters demonstrate that chemical systems are capable of registering exposures to either prompt or residual bomb gamma radiation throughout broad dosage ranges (50 to 5000 r) accurately (±20%). (W.D.M.)

**11078** WT-1531
Army Engineer Research and Development Labs., Fort Belvoir, Va.
SUBSURFACE ACCELERATIONS AND STRAINS FROM AN UNDERGROUND DETONATION. PART II. F. A. Pieper, A. C. Tiemann, and R. H. Sievers, Jr. Oct. 1958. 38p. Project 26.4e [of] OPERATION PLUMBBOB. $1.25(OTS).

Part I issued as ITR-1529.

The objectives of this project were to measure transient and residual ground motion from Shot RAINIER, Operation PLUMBBOB. The measurements consisted of acceleration, pressure, stress, strain, and permanent displacement in the free field below the floor of the main entrance tunnel. Most records were lost because of the zero-time surge in the power supply of the recording instruments. (auth)

**11079** IGRL-T/R-90
IN THE EVENT OF REACTOR DISASTERS, WHAT PROTECTION IS TO BE GAINED BY CONSTRUCTING THE REACTOR WITHIN A ROCK CHAMBER?
H. von Ubisch. Translated by G. Burrows (U.K.A.E.A., Risley) from Tek. Tidskr. 87, 893-8(1957). 13p.

A fixed population can be protected from reactor accidents by the following methods: choice of a type of reactor which is inherently free from the danger of explosion, e.g., the Calder Hall type, whereby the extent of the damage is limited or the risk is eliminated; a reinforced reactor structure, reducing the probability of accidents; inclusion of the reactor in a sealed explosion-proof building which will prevent dispersion; and establishment of free areas, or danger zones, which reduce the possibility of contact with the activity and enable gradual evacuation and protective measures to be taken. The discussion is limited to the problem of confining the reactor in a sealed explosion-proof rock chamber. (L.T.W.)

**11080**
INDIVIDUAL PROTECTION BY MEANS OF FILM DOSIMETRY. F. Wachsmann (Medizinische Universitätsklinik, Erlangen, Ger.) and E. Petrozzi. Minerva nucleare 3, 27-31(1959) Jan. (In Italian)

The requirements of a film dosimetry service are examined and are compared with the results of this method. The possibility is considered of measuring not only the dose but also the energy by means of the multiple filter system and by equations. The causes of major and minor errors are discussed. (auth)

**11081**
YUGOSLAVIAN CRITICALITY ACCIDENT, OCTOBER 15, 1958. Nucleonics 17, No. 4, 106; 154-6(1959) Apr.

A zero-power reactor built for reactor-design experiments and an accident involving the reactor are described. In the detailed description of the facility it is pointed out that the reactor can be started without switching on the flux recorder. This lack of an interlock system and the fact that monitors and safety circuits were turned off made possible the accident of Oct. 15, 1958. An uncontrolled rise of heavy water resulted in a supercriticality which was detected only when operating personnel smelled ozone. Of the eight persons involved, six were flown to the Curie Foundation, Paris, for treatment. One died, and five recovered and returned to Yugoslavia. Calculations are given which indicate that the average whole-body dose from neutrons was 388 rems and from gamma radiation, 295 rems. (T.R.H.)

## INSTRUMENTS

**11082** AECU-3778
General Dynamics Corp. Electric Boat Div., Groton, Conn.
GAMMA SHIELD DESIGN FOR PRIMARY COOLANT SOURCES USING THE IBM TYPE 650 COMPUTER. E. Czapek, R. Gulino, S. Pierce, and J. Shapiro. Sept. 1956. 144p. (RAS-1). $3.00(OTS).

A shield design method employing the IBM type 650 computer is developed. All the necessary equations and procedures are presented. Special attention was given to computation methods and the forms and parameters of the equations to attain minimum storage space and calculating time on the computer. The resulting equations apply only to gamma radiation due to the activation of pressurized water in primary coolant systems (6 Mev decay gamma source). The same analysis may be used however for other sources of radiation. (auth)

**11083** AECU-4077
Illinois. Univ., Urbana. Digital Computer Lab.
TECHNICAL PROGRESS REPORT. PART I. HIGH-SPEED COMPUTER PROGRAM. PART II. MATHEMATICAL METHODS. PART III. SWITCHING CIRCUIT THEORY. PART IV. ILLIAC USE AND OPERATION—GENERAL LABORATORY INFORMATION. Jan. 1959. 24p. Contracts AT(11-1)-415 and Nonr-1834(15). $4.80(ph), $2.70(mf) OTS.

Progress is reported on computer development, mathematical methods, and Illiac use and operation. (For preceding period see AECU-4014.) (A.C.)

**11084** AECU-4091
Illinois. Univ., Urbana. Electrical Engineering Research Lab.
RESEARCH AND INVESTIGATION LEADING TO METHODS OF GENERATING AND DETECTING RADIATION IN THE 100 TO 1000 MICRON WAVELENGTH RANGE OF THE SPECTRUM. Quarterly Progress Report No. 11 [for] September 1, 1958 to December 1, 1958. P. D. Coleman, J. R. Baird, R. C. Becker, B. W. Hakki, J. J. Stafford, R. J. Strain, and A. W. Swago. Mar. 31, 1959. 95p. Contract AT(11-1)-392. $15.30 (ph), $5.40(mf) OTS.

The development of methods for producing and detecting CW (line spectrum) radiations in the 1 to 2 mm wavelength range was continued. The problem is being attacked by frequency conversion and/or multiplication in a nonlinear element or medium. Studies of the use of ferrites as nonlinear elements were continued by developing equations and circuits for evaluating ferrite frequency converting devices. Further experimental work with the gas discharge pulse multiplier is reviewed. The search for new CW generation methods was continued, and some promising techniques are discussed. Extensive theoretical investigations were made of the application of diode rectifiers as multipliers. A slow-wave, high-order mode, dielectric, open-boundary frequency meter was designed and tested. Its performance characteristics are reported. (For preceding period see AECU-3900.) (D.E.B.)

**11085** AERE-C/R-2807
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
EQUIPMENT FOR OBRAINING X-RAY DIFFRACTION PHOTOGRAPHS OF ALPHA ACTIVE MATERIALS. R. W. M. D'Eye, I. F. Ferguson, and R. S. Street. Jan. 1959. 15p. $0.42(BIS).

The installation and operation of Unicam room- and high-temperature x-ray-diffraction cameras in a standard Harwell (Mark II) glove box are described. Methods are given for mounting alpha active samples in a form suitable for use in this equipment. (auth)

**11086** AERE-E/M-70
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
IMPROVED LOW PRESSURE AIR EJECTOR AS A DRY BOX SUCTION UNIT. R. A. G. Welsher. June 30, 1953. 10p.

An investigation to obtain and improve the low-pressure suction flow of an air ejector used for dry box evacuation and to reduce the cost of such ejectors made from copper alloy pipe fittings is described in the Appendix of AERE C/M 152. A filter unit was added to prevent the transfer of contamination from the dry box to the main exhaust ducting. Optimum design figures are recommended. (auth)

**11087** AERE-EL/R-1528
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

SQUARE WAVE POLAROGRAPHY. D. R. Cockbaine. May 5, 1955. 37p.

Electronic devices are described which allow microquantities of electro-reducible substances in solution to be analyzed. Concentrations of $10^{-7}$ moles are determined within 2%, and it is estimated that concentrations of $10^{-10}$ $\underline{M}$ may be evaluated to within 10% using suitable techniques. Recordings of wave height in terms of reciprocal ohms, double layer capacity, and reducing potential are readily obtainable. (auth)

**11088** AERE-GP/R-1187
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
IMPROVED TYPE OF DIELECTRIC AND OTHER LOADED WAVEGUIDES WITH A COAXIAL GAP. L. B. Mullett, W. Walkinshaw, and J. M. Bruce. July 10, 1955. Changed from OFFICIAL USE ONLY Mar. 8, 1957. 25p.

In dielectric-loaded waveguides which have a close fitting metal envelope the major power loss is in the metal. The metal envelope can be removed to a distance for phase velocities less than the velocity of light and can be neglected in the calculations. The behavior of various arrangements of this nature are described. For a phase velocity equal to the velocity of light the metal envelope cannot be neglected, but it can advantageously be removed to a distance both for dielectric and metal loading. The practical significance of these arrangements, especially in relationship to tolerances, is described with reference to conventional loaded waveguides. (auth)

**11089** AERE-HP/M-118
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
AN ADJUSTABLE COUNTING TRAY FOR "INFINITELY-THICK SOURCE" $\beta$ COUNTING IN A 1271 A COUNTER SUPPORT WITH A 2B7 G.M. TUBE. F. G. May. Apr. 1957. 6p.

A counting tray is described which enables large bulky samples, of from 1 to 100 grams, to be counted as infinitely-thick sources, for any beta energy, with exactly reproducible geometry. The counting tray is designed to fit the standard 1271 A G-M counter support. (auth)

**11090** AERE-I/R-1687
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
AN INSTRUMENT FOR THE MEASUREMENT OF HYDROGEN CONTENT OF SOIL AND BULK MATERIAL. G. R. Church and D. B. Smith. June 28, 1955. 8p.

A method of measurement of hydrogen content of bulk material is described, using the moderation of fast neutrons by collision with light nuclei. The method uses a surface instrument and has the advantage that no internal disturbance of the material under test is required. The practical limits of application of the method are discussed, and the results show that hydrogen in all chemical forms is included in the estimation, contrary to some earlier published results. (auth)

**11091** AERE-M/R-2564
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
AN ADIABATIC RISE CALORIMETER FOR MEASURING STORED ENERGY IN IRRADIATED GRAPHITE. R. W. Henson and J. H. W. Simmons. Feb. 1959. 26p. $0.56(BIS).

A vacuum calorimeter is described which can be used to study stored energy release from irradiated graphite under a variety of heat transfer conditions. (auth)

**11092** AERE-Med/R-1948
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
THE ELECTRONIC RED CELL COUNTER. Katharine Williams and C. Sanders. Apr. 24, 1956. 31p.

An electronic red cell counter is described which is a production model developed from the experimental instrument made at Harwell. The principle of counting and the effects of variation of discriminator bias and focus are given, and the method used to determine the accuracy of counts is described. (auth)

**11093** AERE-RE/R-1485
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
AN ANALOGUE COMPUTER FOR REACTOR KINETIC EQUATIONS. I. Wilson and T. E. Burnup. Sept. 16, 1954. 32p.

A computer is described which simulates accurately the behavior of a nuclear reactor over an almost unlimited number of decades of neutron density. Conversely, a small change in neutron density can be represented by the full output swing of the computer. The computer may be used in conjunction with other analogs which simulate the effects of reactor temperature coefficients, external heat exchangers, and servo control mechanisms. (auth)

**11094** CNC-8
Italy. Comitato Nazionale per le Ricerche Nucleari. Divisione Sviluppo Reattori, Rome.
DEUX APPAREILS DEMULTIPLICATEURS D'IMPULSION A POUVOIR RESOLUTIF ELEVE. (Two Pulse Counters of High Resolution.) U. Pellegrini and B. Rispoli. Feb. 1959. 11p.

Presented at International Conference for Nuclear Electronics, Paris, Sept. 16-20, 1958.

Two pulse counters of high resolution (30 nsec) capable of counting rates up to $10^6$ pulses/sec were built. The first instrument has a multiplication factor of 16 and consists of a pulse-forming circuit followed by four binary scalers. A flip-flop circuit is used with cathode follower coupling, capable of fast switching. The tubes used are high transconductance long-lived types. Stability tests of several hundred hours were made, and the instrument was proved to have good stability. The second instrument has a pulse-forming circuit followed by a ring element with a multiplication factor of 5 and then by a normal binary scaler. The ring element has a classical trigger circuit with positive feed-back between dynode and grid. The d-c voltages, the biases, and the coupling between tubes were designed so as to obtain stable operation in the "on" and "off" states. The instrument has the advantage of having a scale factor of 10 and a lower current drain. (J.S.R.)

**11095** CREL-778
Atomic Energy of Canada Ltd., Chalk River Project, Chalk River, Ont.
TRANSISTORIZED COUNTING SYSTEMS. 12. A TRANSISTOR TRIGGER CIRCUIT EXHIBITING AN ACCURATE TRIGGERING THRESHOLD. F. S. Goulding

and L. B. Robinson. Jan. 1959. 30p. (AECL-767). $1.00(AECL).

A transistorized voltage discriminator is described. In the circuit, a forward-biased diode is used to shunt an element in a positive feedback loop and thereby to make the loop stable. When a disturbing signal is fed to the diode to reduce the diode current, the rise in diode impedance may be sufficient to cause the loop gain to exceed unity and a trigger action ensues in the circuit. The report also studies variations of diode characteristics with time and temperature and their effect on the triggering level of the circuit. A description of various time and frequency dependent effects is also included. (auth)

**11096** DP-108
Du Pont de Nemours (E.I.) & Co. Engineering Research Lab., Wilmington, Del.
ION-CHAMBER WATER MONITOR. R. L. McCarthy. Feb. 1955. Decl. Feb. 19, 1959. 33p. Contract AT (07-2)-1. $6.30(ph), $3.00(mf) OTS.

An instrument capable of detecting fission-product contamination in the moderator has been developed. It consists of a thin-walled ion chamber and associated electronic equipment for automatically detecting deviations from normal moderator decay rate. Indication of fission-product activity is independent of power level, flowrate, and other ambient conditions. Tests show the sensitivity and long-term stability to be good. (auth)

**11097** GAT-L-339
Goodyear Atomic Corp., Portsmouth, Ohio.
MASS SPECTROMETER FILAMENT ASSEMBLY ALIGNMENT GAGE. J. Hallis. Feb. 22, 1957. 3p. Contract AT(33-2)-1. $1.80(ph), $1.80(mf) OTS.

The mass spectrometer filament assembly must be aligned properly, otherwise short circuits occur which necessitate changing the source. The alignment gage described makes it possible to accurately and quickly align the filament assembly. (auth)

**11098** HW-39837
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
OPERATION AND MAINTENANCE OF THE MOUSE COUNTER. D. A. Campbell and L. D. Test. Nov. 7, 1955. 13p. Contract [W-31-109-Eng-52]. $3.30(ph), $2.40(mf) OTS.

The mouse counter is a scintillation-type gamma detector for the measurement of the total body burden of a given radioisotope and for the location of the isotope in the bodies of small animals. The counter can also be used as a gamma spectrometer for identification of unknown isotopes. Operating instructions are given as well as maintenance information. (J.R.D.)

**11099** MLM-CF-59-1-54
Mound Lab., Miamisburg, Ohio.
NUCLEAR BATTERY—THERMOCOUPLE TYPE. Quarterly Progress Report No. 8 for October 1, 1958 to December 31, 1958. B. C. Blanke. 30p. DA Project No. 3-99-15-102. Contract R-65-8-99811-SC-01-91.

A demonstration battery containing an 880-curie polonium-210 heat source was constructed and tested. The battery initially had an open circuit voltage of 23.6 volts, a maximum output of 161 milliwatts, and an overall efficiency of 0.57%. Details for the construction of the battery generator are given. (For preceding period see MLM-CF-58-4-59.) (auth)

**11100** ORNL-2658
Oak Ridge National Lab., Tenn.
MEASUREMENTS THROUGH A HOT CELL WINDOW USING OPTICAL TOOLING. A. A. Abbatiello. Apr. 23, 1959. 12p. Contract W-7405-eng-26. $3.30(ph), $2.40(mf) OTS.

Optical tooling was evaluated for the measurement of physical dimensions of radioactive parts through hot cell windows. Instruments were set up outside a 4-ft-thick lead-glass window. Although the window was not specially selected, the readings were within 1.0% of the true dimension. Use of a calibration chart of the window variations reduced the error to ±0.1%. The method is considered feasible and sufficiently fast for a wide range of hot cell measurements. The reflections of a point light source from the lead-glass laminae form a convenient indicator of the window's measurement qualities. (auth)

**11101** RDB(CA)/TN-99
Gt. Brit. Capenhurst Works, Capenhurst, Ches., England.
THE BEHAVIOUR OF A SONIC ANALYSER WITH IMPERFECT GASES. J. F. Ellis, J. Scrivins, and J. S. Rowlinson. Aug. 1953. 14p.

The resonant frequency of a sonic analyzer filled with an imperfect gas is found to fall with increasing pressure above 250mm Hg. This is shown to be due to the departure of the gas from the perfect gas laws. At pressures below 200mm the frequency is lower than would be expected. No explanation of this is given. It is found that the response of the instrument is not truly linear over a frequency range of times 2, or greater. (auth)

**11102** SCTM-15-59(14)
Sandia Corp., Albuquerque, N. Mex.
IMPEDANCE OF A FOLDED CIRCULAR LOOP ANTENNA. Charles W. Harrison, Jr. Jan. 20, 1959. 27p. Contract AT-(29-1)-789. $4.80(ph), $2.70(mf) OTS.

The principle of superposition of circuits is employed to obtain the impedance of a folded circular loop radiator (often called a Halo antenna) as a function of the impedance of an unloaded loop of the same dimensions; the ratio of the current at the driving point and at a diametrically opposite point on the periphery of the unloaded loop; and the impedance of a suitably dimensioned short-circuited two-wire transmission line of circular shape. (auth)

**11103** SCTM-38-59(14)
Sandia Corp., Albuquerque, N. Mex.
A VOLTAGE REGULATOR FOR HALF-WAVE, CAPACITOR-INPUT POWER SUPPLIES. Thomas W. Moody. Feb. 26, 1959. 18p. Contract AT(29-1)-789. $3.30(ph), $2.40(mf) OTS.

Saturable reactors using cores of material with rectangular hysteresis loops can be used to obtain load voltage regulation in some types of circuits. This effect can be enhanced by the use of nonlinear resistances or "varistors" in conjunction with the saturable reactor. The characteristics of such a regulator include features which should make it attractive for use in circuits delivering fairly high d-c voltages and where power requirements are small. (auth)

**11104** WAPD-RM-78
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
NUCLEAR POWER PLANT SIMULATOR. Robert George Durnal. Feb. 1952. Decl. Mar. 12, 1959. 68p. Contract AT-11-1-GEN-14. $10.80(ph), $3.90(mf) OTS.

An electronic analog computer is discussed which has been built to solve, on a natural time base, the differential equations which describe the kinetic behavior of a nuclear power plant. The theory of operation of the simulator is treated in detail, and a description of the physical equipment is given. Results of various tests run on the simulator are presented, although for security reasons no actual values of temperature or power variations can be given. Plans for future expansion of the simulator are also outlined. (auth)

**11105** AEC-tr-3632

A NEW MAGNETIC $\beta$-SPECTROMETER. V. M. Kel'man. Translated by Lydia Venters (Argonne National Lab.) from *Vestnik Akad. Nauk S.S.S.R.* 28, No. 7, 75-8(1958). 7p. $1.80(ph), $1.80(mf) JCL or LC.

This paper was previously abstracted from the original language and appears in *NSA*, Vol. 13, as abstract No. 175.

**11106** AERE-Trans-11/3/5/1181

A LABORATORY APPARATUS FOR PURITY TESTING OF A HELIUM FLOW. D. I. Vasil'ev. Translated by J. B. Sykes (U.K.A.E.A. Atomic Energy Research Establishment) from *Pribory i Tekh. Ekspt.* No. 4, 107(1958). 3p. $1.80(ph), $1.80(mf) JCL or LC.

An apparatus for determining air in a helium flow by use of platinum bridge elements is described. The sensitivity at the operating current (200 ma) is 1 mv/0.2% air in helium. (J.R.D.)

**11107** CEA-tr-R-277

MÉCANISME DE LA VARIATION DES IMPULSIONS DANS LES COMPTEURS-$\alpha$ AU SCd EN FONCTION DE L'IRRADIATION PAR LA LUMIÈRE DANS LE DOMAINE VISIBLE. (Mechanism of the Variation of Pulses in $\alpha$ Counters with CdS as a Function of Irradiation by Light in the Visible Range.) A. V. Aǐrapetyants (Aǐrapetiantz) and S. M. Ryvkin (Ryvkine). Translated into French from *Zhur. Tekh. Fiz.* 27, 106-12(1957). 12p.

An apparatus and technique are described which were used to study the effects of light in the visible spectrum on alpha counting using CdS crystals. A mathematical expression of the relationships involved is given. The experimental results in the form of pulse amplitude in the CdS crystal versus light wavelength and temperature are compared and treated in the mathematical formula. The experimental data indicate a semiconductor character for the mechanism of formation of the pulses. (T.R.H.)

**11108** CEA-tr-R-515

MÉTHODES ÉLECTRONIQUES DE FORMATION DES IMPULSIONS ULTRA-BRÈVES. (Electronic Methods of Formation of Ultra-Short Pulses.) A. Kaporskii (Kaporsky), A. Chernetskii (Tchernetsky), and V. Voznessenskii (Voznessensky). Translated into French by I. Melnick from *Uspekhi Fiz. Nauk* 63, 801-12(1957). 21p.

The various electronic pulse generators are described and discussed. (T.R.H.)

**11109** HW-tr-2

A NEW LARGE CAPACITY CONTINUOUS COUNTER FOR IMPROVED DETERMINATION OF GROSS RADIOACTIVITY IN WATER ACCORDING TO THE VAPOR METHOD. Hans Kiefer and Rupprecht Maushart. Translated by B. B. Lane (Hanford Atomic Products Operation) from *Nukleonika* 1, 103-6(1958). 10p. $1.80(ph), $1.80(mf) JCL or LC.

This paper was previously abstracted from the original language and appears in *NSA*, Vol. 12, as abstract No. 17617.

**11110** SCL-T-227

SYMMETRIZATION ARRANGEMENT. (Symmetrieranordnung.) Ernst Gerhard. Translated by Marcel I. Weinreich (Sandia Corp.) of German Patent No. 891,863, German Patent Office, Berlin. 9p. $1.80(ph), $1.80 (mf) JCL or LC.

The invention described in this patent concerns a symmetrization arrangement which performs essentially the same as the well-known symmetrization loop but which is considerably more simple in design and manufacture. (A.C.)

**11111**

CONSTRUCTION OF AN X-RAY OR GAMMA DOSIMETER UTILIZING A PLASTIC SCINTILLATOR. José M. Codina Vidal (Instituto de Electricidad y Automatica del C.S.I.C., Facultad de Ciencias, Barcelona). *Anales real soc. españ. fís. y quím. (Madrid) Ser. A* 55A, 61-4(1959) Jan.-Feb. (In Spanish)

The exposure dose and the exposure dose rate of x or gamma radiation are measured making use of the fluorescence of a plastic scintillator under the action of radiations. The light emitted by this plastic is collected by a photomultiplier; the exposure dose rate is registered by a microammeter and the exposure dose by two decade counter tubes. (auth)

**11112**

ABSOLUTE $\beta$-COUNTING IN A PROPORTIONAL FLOW-COUNTER. J. P. Roalsvig and R. N. H. Haslam (Univ. of Saskatchewan, Saskatoon, Can.). *Can. J. Phys.* 37, 499-514(1959) Apr.

Self-absorption and backscattering of $\beta$ particles were studied in a proportional flow-counter, and empirical formulas are obtained to correct for these factors in absolute $\beta$ counting. The correction factors will depend on the thickness of the sample, the atomic number of the backscattering material, and the maximum energy of the $\beta$-particles. Relationships between the mass-absorption coefficient and the maximum energy of the $\beta$ particles for the primary $\beta$ particles, and between the mass-absorption coefficient, the maximum energy of the $\beta$-particles, and the atomic number of the backscattering material for the backscattered $\beta$ particles, are obtained. The backscattering function is found to depend on the atomic number of the backscattering material alone. (auth)

**11113**

PHOTOGRAPHIC METHOD IN X AND $\gamma$ RAY DOSIMETRY. F. Běhounek, J. Klumpar, J. Kočí, and P. Jiroušek (Inst. of Nuclear Physics, Prague). *Czechoslov. J. Phys.* 7, 599-613(1957). (In German)

An analysis was made of x and $\gamma$ radiation dosimetry by photographic emulsion blackening. Experiments were made for determining the dependence and relation of direction and saturation factors. A method is suggested for photofilm calibration with $Co^{60}$ $\gamma$ rays, which can be accomplished under any working conditions. The discrimination and correlation of x and $\gamma$ radiation energy were carried out with a 1 mm thick lead coated film. Applications of photographic methods for personnel protection in complex working places with photon emissions of various energies are discussed. (tr-auth)

**11114**

A STUDY OF THE INTEGRAL AND LOCAL SENSITIVITY OF PHOTOCATHODES AND ITS INFLUENCE ON THE SCINTILLATION DETECTOR PLATEAU. Josef Šilar and Olga Nováková (Research Inst. for Electrotechnical Physics, Prague). *Czechoslov. J. Phys.* 7, 614-23(1957). (In Russian)

In the framework of γ-ray spectroscopy a study was made of the integral, blue, and local sensitivities of photocathodes from photomultipliers FEU 19, RCA 5819, EMU 5311 and Czechoslovak sample 61 PK 411, and their influence on the length and ascent of the scintillation detector plateau. (tr-auth)

**11115**

AN IMPROVED TECHNIQUE FOR THE THERMAL PRECIPITATION OF AEROSOLS FOR ELECTRON MICROSCOPY. N. A. Fuks and S. S. Yankovskii (Scientific Research Inst. of Non-Ferros Metals, Moscow). Kolloid. Zhur. 21, 132-4(1959) Jan.-Feb. (In Russian)

A new technique for the thermal precipitation of aerosols on a thin organic film is described, by which the usual errors caused by the preferential settling of particles along the wires of the supporting net are eliminated. (auth)

**11116**

AN EASY TECHNICAL MODIFICATION FOR THE ADAPTATION OF COMMON SCINTILLATORS TO THE DETERMINATION OF BETA-EMITTING RADIONUCLIDES (WITH SPECIAL REGARD FOR C$^{14}$). G. Curci (Univ. of Naples). Minerva nucleare 3, 12-15(1959) Jan. (In Italian)

The reasons of low counting efficiency for C$^{14}$ of end-window G-M counters are briefly discussed, and the use of current γ scintillators is proposed. This can be done by substituting the NaI/Tl crystal with a plastic phosphor. On the basis of the experimental data, anodic and bias voltage are discussed in order to obtain the highest efficiency and a remarkable sensitivity with the minimum of statistical indetermination. The efficiency of the modified scintillator is many times higher than that of thin end-window G-M counters. The technique was also applied to the counting of P$^{32}$; results were better than with G-M counter provided a proper choice of anodic and bias voltage was made. A further improvement may be obtained by utilizing part of the radiation emitted in the direction opposite to the detector by positioning the sample between two phosphors and reflecting on the photocathode the light from the upper phosphor by means of a mirror surface. The results obtained by this inexpensive adaptation of a common scintillator for routine clinical use are almost of the same order as those obtained by means of costly instruments, as gas flow counters on liquid scintillators. (auth)

**11117**

THE BUBBLE CHAMBER AND ITS APPLICATION IN THE PHYSICS OF ELEMENTARY PARTICLES. K. Gottstein (Max-Planck-Institut fur Physik und Astrophysik, Munich). Naturwissenschaften 46, 97-102(1959). (In German)

A brief comparison is made of the characteristics of bubble chambers with those of scintillation counters, nuclear emulsions, expansion cloud chambers, and diffusion cloud chambers. The history of the development of the bubble chamber and the physics of the instrument are described. Examples of the investigations possible with a hydrogen bubble chamber are given. 23 references. (J.S.R.)

**11118**

METHOD AND DEVICE FOR THE SENSING OF NEUTRONS. Siemens-Schuckertwerke A.G. (Germany). British Patent 800,636. Nuclear Eng. 4, 188(1959) Apr.

A neutron detection device is described employing a semiconductor as the sensitive element. Detection is effected by recording the changes in the electrical characteristics of a semiconductor on exposure to neutrons. It is proposed to use materials comprising an element of the third group and an element of the fifth group of the Periodic System and to incorporate also at least one of the two elements boron and nitrogen. Nitrogen compounds are particularly suitable for the detection of neutrons of medium and large energy and boron compounds for the detection of slow neutrons.

**11119**

SCINTILLATION SCREENS. G. V. Planer and R. W. Windebank and G. V. Planer, Ltd. British Patent 801,384. Nuclear Eng. 4, 188(1959) Apr.

The conventional type of scintillation screen has a cover of extremely thin aluminum foil to serve as a reflector. The fragility of this foil frequently causes failure. In the screen, designed according to the present invention, the phosphor particles are embedded in a transparent carrier of polystyrene or polymethyl methacrylate, the carrier being closer to the phosphor surface than in the past. The surface may be coated with one or more metallic layers by means of cathodic sputtering or vacuum evaporation, or alternatively by transfer methods.

**11120**

AN AUTOMATIC COUNTER FOR IRRADIATED FOILS. M. F. Smith (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nuclear Power 4, No. 35, 108-10(1959) Mar.

An automatic counter for irradiated foils with three counting heads is described in detail. The foil-changing mechanism consists of a horizontal turntable divided into quadrants. In three of the quadrants are counting channels and in the fourth the foils are loaded and unloaded. The printing out of the results from dekatron scaling units onto a paper roll is described. (W.D.M.)

**11121**

TRANSISTORS SHRINK CONTAMINATION DETECTORS. W. G. Spear (General Electric Co., Richland, Wash.). Nucleonics 17, No. 4, 97-101(1959) Apr.

A transistor alpha hand monitor device and a portable kicksorter are described. The new hand monitor employing scintillation fluors on light pipes is more sensitive, is less than $\frac{1}{3}$ as large, costs less, and is less expensive to maintain than the Four-Fold instrument it replaces. The scintillator system, circuits, controls, operation, and calibration are described. The portable kicksorter weighs 7 lb, has a battery life of 250 hours, and spans energies from 0.1 to 1.5 Mev with 10 turns of a dial, with simple adjustment to an upper limit at 2.0 Mev. The minimum stable window width is 10 to 20 kev giving a system resolution with Cs$^{137}$ of 13.4%. (T.R.H.)

**11122**

PORTABLE TRITIUM MONITOR HAS GAMMA COMPENSATION. J. D. Anthony (E. I. du Pont de Nemours and Co., Aiken, S. C.). Nucleonics 17, No. 4, 110; 112; 114(1959) Apr.

A portable tritium monitor is described, designed on the air-sampling principle of the Los Alamos 101 Sniffer and the Tracerlab Tritium-Flow Monitor but having an additional gamma-compensating chamber. The two Plexiglas ionization chambers, ~1600 cm$^3$ volume, have conductive walls equally and oppositely polarized. The collecting electrodes are connected to the grid of the electrometer tube. Any radiation common to both chambers results in cancellation of current flow across the high input resistance. The compensating chamber is closed and has an inside false brass wall which is moved to compensate for small differences in effective volume. The deionizer, motor and blower, electronics, and calibration of the instrument are also described. It accurately detects T in the concentration range 4 to 1600 × $10^{-5}$ $\mu c/cm^3$, and weighs 16 lb, having over-all dimensions of 5 × 10 × 16 in. (T.R.H.)

**11123**

COATED SEMICONDUCTOR IS TINY NEUTRON DETECTOR. R. V. Babcock, R. E. Davis, S. L. Ruby, K. H. Sun, and E. D. Wolley (Westinghouse Electric Corp., Pittsburgh). Nucleonics 17, No. 4, 116; 118; 120; 122(1959) Apr.

Neutron detection using semiconductors is discussed, and the detectors themselves and their usefulness are described. The detector consists of a pn junction coated with a nuclide, $B^{10}$, $U^{235}$, or $Li^6$, which produces energetic charged particles from neutron irradiation. For fast neutrons the system is surrounded with paraffin to provide proton recoils. The detectors are small, ~1 mm on an edge, making spatial resolution rivaling foil techniques available at less cost and effort. Experiments with different types are described and discussed. (T.R.H.)

**11124**

HIGH-LEVEL DOSIMETRY BY LUMINESCENCE DEGRADATION. Frank H. Attix (U. S. Naval Research Lab., Washington, D. C.). Nucleonics 17, No. 4, 142-4; 146-8(1959) Apr.

A dosimeter is described which is accurate to ~10% in the range $5 \times 10^5$ to $5 \times 10^9$ rads. Two penny-size wafers of anthracene and p-terphenyl are read before and after irradiation with a fluorimeter that excites with 3650 A ultraviolet and measures the resulting fluorescence at 4420 A with a photomultiplier. Dose-rate effects are negligible in the range $5 \times 10^5$ to $3 \times 10^8$ rads/hr. (T.R.H.)

**11125**

THEORY OF ELECTROSTATIC PROBES IN A LOW-DENSITY PLASMA. Ira B. Bernstein and Irving N. Rabinowitz (Princeton Univ., N. J.). Phys. Fluids 2, 112-20(1959) Mar.-Apr.

The theory of sperical and cylindrical probes immersed in plasmas of such low density that collisions can be neglected is formulated. The appropriate Boltzmann equation is solved, yielding the particle density and flux as functionals of the electrostatic potential, the situation in the body of the plasma, and the properties of the probe. This information when inserted in Poisson's equation serves to determine the potential, and hence the probe characteristic. No a priori separation into sheath and plasma regions is required. Though amenable to a determination of the full probe characteristic, the method is applied in detail and numerical results are presented only for the collection of monoenergetic ions, for the case of negligible electron current. These results indicate that the potential is not so insensitive to ion energy as has been believed, and that if the probe radius is sufficiently small, there enters the possibility of a class of ions which are trapped near the probe in troughs of the effective radial potential energy. The population of these trapped ions is determined by collisions, however infrequent. It is difficult to calculate, and conceivably can have a marked effect on the local potential. (auth)

**11126**

CONTEMPORARY ELECTRONOGRAPHIC APPARATUSES. Z. G. Pinsker (Inst. of Crystallography, Academy of Sciences, U.S.S.R.). Pribory i Tekh. Ekspt. No. 1, 3-16(1959) Jan.-Feb. (In Russian)

A review is presented of the various electron microscope designs, their performance, and techniques of application. (R.V.J.)

**11127**

SECTION BETA SPECTROMETER WITH DOUBLE FOCUSING. D. L. Kaminskii and M. G. Kaganskii (Inst. of Physics and Tech., Academy of Sciences, U.S.S.R.). Pribory i Tekh. Ekspt. No. 1, 32-6(1959) Jan.-Feb. (In Russian)

Descriptions are given of a $\beta$ spectrometer with a double-focusing beam in a nonuniform axially symmetric magnetic field. The source is in the magnetic field while the detector is outside the field. With a solid angle of 0.9% from $4\pi$, the half-width of the conversion line is 1.3%; with a solid angle of 0.3%, the half-width is 0.36%. (tr-auth)

**11128**

COMPTON DOUBLE-CRYSTAL HIGH LUMINOSITY GAMMA SPECTROMETER. V. V. Ovechkin and A. A. Sorokin (Scientific Research Inst. of Nuclear Physics, Moscow). Pribory i Tekh. Ekspt. No. 1, 36-40(1959) Jan.-Feb. (In Russian)

The design is presented of a double crystal Compton $\gamma$ spectrometer without $\gamma$ beam collimation. A method is suggested for eliminating the effects of cascade transitions. Measurements of total luminosity in the energy range 511 to 2100 kev showed that it surpasses the luminosity of a collimated Compton spectrometer. (tr-auth)

**11129**

PROPANE BUBBLE CHAMBER OF 24 LITER VOLUME. Van Gan-Chan, M. I. Solov'ev, and Yu. N. Shkobin (Joint Inst. of Nuclear Research, Dubna, U.S.S.R.). Pribory i Tekh. Ekspt. No. 1, 41-3(1959) Jan.-Feb. (In Russian)

Descriptions are given of a 24-liter propane bubble chamber with a photographing volume of 55 × 28 × 14 cm. The chamber operates in a constant magnetic field. Water, separated from propane by sulfones, is used for transmitting pressure. The dilator with an electromagnetic value is installed in the scattering field. The illumination is at 90° to the photographing axis. A black glass, placed on the bottom of the chamber, supplies the background. (R.V.J.)

**11130**

NUCLEAR EMULSIONS WITH POWDER FILLERS. S. S. Vasil'ev, V. V. Komarov, and A. M. Popova (Scientific Research Inst. of Nuclear Physics, Moscow). Pribory i Tekh. Ekspt. No. 1, 48-50(1959) Jan.-Feb. (In Russian)

The preparation of nuclear emulsions with a fine powder filler distributed between emulsion layers is described. A method is offered for measuring the distortions in the emulsion and the amount of the filler used. (tr-auth)

**11131**

THE EFFECTS OF BETA-SPECTROMETER FOCUSING POWER ON THE END-WINDOW COUNTER EFFICIENCY. I. A. Vasil'ev and K. A. Petrazhak (Leningrad Inst. of Tech.). Pribory i Tekh. Ekspt. No. 1, 57-61(1959) Jan.-Feb. (In Russian)

The efficiency dependence of end-window counters on specimen surface density at a relative solid angle 0.111 was determined with the aid of a 4π counter. The isotopes $S^{35}$, $Ca^{45}$, $Co^{60}$, $Ce^{141}$, $Tl^{204}$, and $Y^{91}$ were studied. (tr-auth)

**11132**

INVESTIGATIONS OF SLOW NEUTRON COUNTERS. V. Ya. Savel'ev and V. A. Kononenko. Pribory i Tekh. Ekspt. No. 1, 61-4(1959) Jan.-Feb. (In Russian)

A simplified theory of the phenomena taking place in slow neutron counters filled with gaseous $BF_3$ is described. Relations are derived for pulse amplification, efficiency and initial count, intensity, pressure, and counter construction parameters. Results are presented from a study of counter parameter dependence on initial count, amplitude and efficiency, plateau position, pressure, electrode potential differences, discriminator voltage, and design dimensions. The experimental data and simplified theoretical derivations were in satisfactory agreement. (tr-auth)

**11133**

THERMAL STABILITY OF HALOGEN COUNTERS. V. G. Chaikovskii. Pribory i Tekh. Ekspt. No. 1, 65-6(1959) Jan.-Feb. (In Russian)

It was found that the effect of temperature on the performance of halogen counters can be explained by the saturation of the working area by evaporation of volatile products produced by halogen interactions with the counter structural materials. Preliminary clearance of these products increases the counter thermal stability up to 170 to 200°C. (tr-auth)

**11134**

ACTIVITY OF PREPARATIONS DECAYING BY ELECTRON CAPTURE. A. A. Konstantinov (All Union Research Inst. of Metrology). Pribory i Tekh. Ekspt. No. 1, 67-9(1959) Jan.-Feb. (In Russian)

The activity of preparations decaying by electron capture was measured with a 4π counter. The activity was determined by the number of characteristic x-ray quanta emitted by a daughter element of the examined preparations. (R.V.J.)

**11135**

MULTICHANNEL AMPLITUDE PULSE ANALYZER WITH LOGARITHMIC CONVERSION. L. S. Bagdasaryan and V. M. Kharitonov (Inst. of Physics, Academy of Sciences, Armenian S.S.R.). Pribory i Tekh. Ekspt. No. 1, 70-2(1959) Jan.-Feb. (In Russian)

Descriptions are presented of a pulse amplitude analyzer with logarithmic conversion in which the pulse measurements are equally accurate for the whole range. The analyzer is designed for operation with a five-layer proportional counter for cosmic radiation studies. Performance curves are included. (tr-auth)

**11136**

NON-OVERLOADING LINEAR AMPLIFIER WITH HIGH-SPEED COUNTING RANGE. A. S. Melioranskii and Yu. M. Ostanevich (Scientific Research Inst. of Nuclear Physics, Moscow). Pribory i Tekh. Ekspt. No. 1, 73-6(1959) Jan.-Feb. (In Russian)

Descriptions are given of a linear nonoverloading amplifier designed for use with a scintillation transducer with a counting range of $10^5$ imp/min. (tr-auth)

**11137**

SPECTROMETER FOR STUDYING ELECTRON PARAMAGNETIC RESONANCE. A. G. Semenov and N. N. Bubnov (Inst. of Physical Chemistry, Academy of Sciences, U.S.S.R.). Pribory i Tekh. Ekspt. No. 1, 92-6(1959) Jan.-Feb. (In Russian)

Descriptions are given of a spectrometer for studying electron paramagnetic resonance in the 3-cm wave range. The spectrometer employs high-frequency magnetic field modulation and an automatically tuned klystron generator frequency. (tr-auth)

**11138**

MAGNETIC FIELD STABILIZER BASED ON THE NUCLEAR INDUCTION EFFECT. Yu. N. Denisov (Joint Inst. of Nuclear Research, Dubna U.S.S.R.). Pribory i Tekh. Ekspt. No. 1, 96-100(1959) Jan.-Feb. (In Russian)

A design is presented for a magnetic field intensity stabilizer in the range of 1500 to 2000 gauss. Accuracy is of the order of $2 \times 10^{-3}\%$. (tr-auth)

**11139**

OMEGATHRON. N. I. Leont'ev and Yu. K. Udovichenko. Pribory i Tekh. Ekspt. No. 1, 101-5(1959) Jan.-Feb. (In Russian)

A mass analyzer designed for measuring light masses and based on the ion cyclotron resonance is described. The apparatus is highly sensitive. The precision of the apparatus is ± 5%. (tr-auth)

**11140**

APPLICATIONS OF A MONITOR IN X-RAY SPECTRAL ANALYSIS. M. A. Blokhin, I. V. Busler, O. P. Kramarov, and I. P. Chernyavskaya (Rostov-on-Don State Univ.). Pribory i Tekh. Ekspt. No. 1, 106-11 (1959) Jan.-Feb. (In Russian)

An electron scheme for regulating the incandescence of the x-ray tube cathode was designed in order to achieve an automatic stabilization of the fluorescent x-ray emission intensity. The monitor (an auxiliary Geiger counter) was used as the intensity transmitter. (tr-auth)

**11141**

METHODS AND APPARATUS FOR LOW TEMPERATURE OPTICAL AND SPECTRAL ANALYSIS. V. P. Babenko, V. L. Broude, V. S. Medvedev, and A. F. Prikhot'ko (Inst. of Physics, Academy of Sciences, Ukrainian S.S.R.). Pribory i Tekh. Ekspt. No. 1, 115-20(1959) Jan.-Feb. (In Russian)

Descriptions are given of the performance of a metallic cryostat at liquid helium and hydrogen temperatures. The special design achieved lower stable temperatures and reduced hydrogen and helium requirements. The cryostat is adapted for microprojection investigations of crystal absorption and luminescence in free and intensified states, and for measuring optical and photoelectric crystal temperatures. (tr-auth)

**11142**

IONIZATION CHAMBER FOR COSMIC RAY STUDIES. N. N. Goryunov and A. D. Erlykin (Scientific Research Inst. of Nuclear Research, Moscow). Pribory i Tekh. Ekspt. No. 1, 130-1(1959) Jan.-Feb. (In Russian)

Descriptions are given of an electron-pulse ionization chamber with a cube-shaped working area which fits tightly over the cosmic-ray recording area. The electric field distribution in the working area of the chamber, used for evaluating basic parameters, was in the form of ohmic resistances. (tr-auth)

**11143**

USE OF CARBONIC ACID AS THE WORKING LIQUID IN BUBBLE CHAMBERS. E. V. Kuznetsov and I. Ya. Timoshin. Pribory i Tekh. Ekspt. No. 1, 132(1959) Jan.-Feb. (In Russian)

It was found that carbonic acid can be used satisfactorily in experiments related to isotopic spin, in particle polarization, or in determining particle parities. Carbonic acid has many favorable features: it is readily available, noncombustible, is in liquid form, and does not require additional purification. (R.V.J.)

**11144**

A PORTABLE NEUTRON DOSIMETER. Yu. I. Gribanov. Pribory i Tekh. Ekspt. No. 1, 133-4(1959) Jan.-Feb. (In Russian)

A design is given for a fast neutron dosimeter which operates with semi-conducting triodes and a small photomultiplier. (tr-auth)

**11145**

REMODELED POCKET DOSIMETER CHARGER. V. B. Stradomskii (Inst. of Hydrochemistry, Academy of Sciences, U.S.S.R.). Pribory i Tekh. Ekspt. No. 1, 134(1959) Jan.-Feb.

The circuitry is given for an improved pocket chamber charger which has performed satisfactorily for over 1½ years. (R.V.J.)

**11146**

THE PERFORMANCE OF VARIOUS TYPES OF PHOTOMULTIPLIERS IN WEAK MAGNETIC FIELDS. L. I. Zlobin, Yu. A. Nemilov, and A. N. Pisarevskii (Radium Inst., Academy of Sciences, U.S.S.R.). Pribory i Tekh. Ekspt. No. 1, 140-1(1959) Jan.-Feb. (In Russian)

Data are presented on the variations in the general sensitivity, amplitude resolution, and the rise in the current pulse front of various types of photomultipliers in weak magnetic fields. (tr-auth)

**11147**

INSTALLATION FOR PRODUCING STRONG SHORT-DURATION MAGNETIC FIELDS. V. R. Karasik (Moscow State Univ.). Pribory i Tekh. Ekspt. No. 1, 142-5(1959) Jan.-Feb. (In Russian)

An installation for producing strong, short-duration magnetic fields is described. The field, $3 \times 10^5$ gauss and 0.7 $cm^3$, is produced by discharging condenser banks; the oscillation period is $2 \times 10^{-4}$ sec. The design and assembly of equipment are described. (tr-auth)

**11148**

STRONG-FOCUSING X-RAY TUBE WITH ADSORPTION PUMP. V. S. Kogan, V. P. Selivanov, and R. F. Bulatova (Inst. of Physics and Tech., Academy of Sciences, Ukrainian S.S.R.). Pribory i Tekh. Ekspt. No. 1, 145-7(1959) Jan.-Feb. (In Russian)

Descriptions are given of an x-ray installation which uses adsorption pumps in place of diffusion pumps. The installation was developed and successfully used in the cryogenic laboratory. (R.V.J.)

**11149**

HIGH-SPEED ELECTRONIC VACUUM VALVE. I. S. Sphigel (Inst. of Physics, Academy of Sciences, U.S.S.R.). Pribory i Tekh. Ekspt. No. 1, 151(1959) Jan.-Feb. (In Russian)

A design is presented for a high-speed vacuum valve operating on the principle of electronic circuit interactions. (R.V.J.)

**11150**

DIGITAL DATA-RECORDING FOR NUCLEAR EXPERIMENTS. R. C. M. Barnes (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Trans. Soc. Instr. Technol. 11, No. 1, 49-58(1959) Mar.

Devices for recording digital data in a form suitable for automatic processing are a feature of the nuclear instruments described in this paper. Examples include recording on cards, since most data-processing at AERE will be handled by a punched-card installation, and also the use of paper tape or magnetic tape when large quantities of data have to be recorded at unattended equipment. Processing required for data from nuclear experiments ranges from simple operations performed on specialized computer-type equipment to calculations requiring a high-speed digital computer. (auth)

**11151**

IONIZATION DIFFRACTOMETER FOR X-RAY ABSORPTION STUDIES. S. M. Karalnik (Kiev State Univ.). Ukrain. Fiz. Zhur. 3, 678-82(1958) Sept.-Oct. (In Ukrainian)

A description is given of an experiment using an ionization diffractometer to study the characteristic absorption of x rays. The so-called "fixed counter" method was used and for the rapid determination of relative changes in the absorption edges of elements. (auth)

**11152**

DESIGN OF AN IONIZATION CHAMBER WITH FILTERS. O. F. Nemets, E. A. Pavlenko, and M. V. Sokolov (Inst. of Physics, Academy of Sciences, Ukrainian S.S.R.). Ukrain. Fiz. Zhur. 3, 837-9(1958) Nov.-Dec. (In Ukrainian)

A design is presented of an ionization chamber with filters in which the electrical field intensity between the filters and electrode collector and between the high voltage electrode and filters does not differ more than 1.3 times. A high-precision recording was achieved for electron energies of 1 to 1.3 ev. (R.V.J.)

**11153**

INVESTIGATIONS OF SPECTRAL LINE IMAGES CONSIDERING THE ILLUMINATION OF THE SPECTROGRAPH ENTRANCE SLIT AND PRISM. N. I. Kozhevnikov. Vestnik Moskov. Univ. Ser. Mat. Mekhan. Astron. Fiz. i Khim. 13, No. 3, 51-64(1958). (In Russian)

Conditions of prism illumination under which the prism frame diffraction interferes with spectral line images and the effects of various membranes, placed in front of the prism, are investigated. (R.V.J.)

**11154**

EXPOSURE GRAPHS IN BETATRON GAMMA-DEFECTOSCOPY. A. E. Buzynov, M. D. Mochalov, and I. G. Fakidov (Inst. of Metal Physics, Academy of Sciences, U.S.S.R.). Zavodskaya Lab. 24, 986-8(1959). (In Russian)

The method for plotting exposure graphs and for graph analysis for calculating the exposure time of Soviet made films is described. (R.V.J.)

**11155**

SCINTILLATION METHODS OF MEASURING LOW RADIOACTIVITY. V. F. Smirnov. Zavodskaya Lab. 24, 989-95(1958). (In Russian)

A review is presented of scintillation measurement methods for low-level $\alpha$, $\beta$, and $\gamma$ activities. (R.V.J.)

**11156**

MEASUREMENTS OF SMALL QUANTITIES OF RADIUM AND THORIUM EMANATIONS BY PULSE IONIZATION CHAMBER. A. M. Babeshkin, V. I. Baranov, and K. B. Zaborenko (Lomonosov Moscow State Univ.). Zavodskaya Lab. 24, 996-7(1958). (In Russian)

Measurements of specimens at 300 to 500 cpm showed a mean quadratic error of ±1%. The new standard ionization chamber background is 1 to 1.5 cpm for measuring times of 24 hours. Radium detection sensitivity was $(4 \pm 1.6) \times 10^{-14}$ g. (R.V.J.)

**11157**
SCINTILLATION SPECTROMETERS IN USE FOR IDENTIFICATION OF RADIOISOTOPES. A. A. Sorokin, L. S. Novikov, and F. I. Pavlotskaya (Vernadskii Inst. of Geochemistry and Analytical Chemistry). Zavodskaya Lab. 24, 997-1000(1958). (In Russian)

A scintillation spectrometer was used for identifying radioisotopes in ionic exchange separations of rare earth isotopes produced in uranium fission by 680-Mev protons. Correlations of isotopic identifications by scintillation spectrometer and G-M counter indicated the advantages of the scintillation spectrometer. The use of a multichannel analyzer speeds the spectral recording process, which can be operated with very small sources ($10^{-8}$ c). (R.V.J.)

## METALLURGY AND CERAMICS

**11158** AECU-4023
Horizons, Inc., Cleveland.
PRELIMINARY STUDY OF THE EQUILIBRIUM OF CARBON AND OXYGEN IN COLUMBIUM WITH CARBON MONOXIDE ABOVE 1600°C. M. E. Sibert and M. A. Steinberg. [1958]. 19p. Contract AT(30-1)-1894. $3.30(ph), $2.40(mf) OTS.

Presented at the Third Reactive Metals Conference, Buffalo, May 27-29, 1958.

The linearity obtained for $K^1$ and $\Delta F^1$ values appears to demonstrate the validity of the assumptions made in regard to solution of C and O in niobium metal. Free energy values obtained are roughly what would be expected, the reaction becoming favorable at just under 1700°C. In order to obtain low oxygen values on a Nb product, it would be necessary to heat to an excess of 2000°C. This is borne out experimentally. (auth)

**11159** AECU-4067
Eagle-Picher Research Labs., Joplin, Mo.
STUDIES ON THE DE BOER PROCESS OF ZIRCONIUM PRODUCTION. Final Report [for] August 11, 1954 to October 31, 1955. Dec. 30, 1955. 122p. Contract AT(11-1)-319. $19.80(ph), $6.30(mf) OTS.

The development of a replacement feed for Zr sponge in the deBoer-iodide deposition process for Zr production was investigated. A feed product containing 25 to 40% free metallic Zr was made by arc-melting in a vacuum, a mixture of C and $ZrO_2$ bonded with dextrines. The feed material iodinates approximately half as rapidly as sponge. The deposition rate in the deBoer bulb, however, is about 25% of that for sponge. Part of the N content of the feed is liberated on iodination and, due to the high temperature of the deposition wire, the N will transfer and be absorbed by the Zr. The N transfer can be reduced by continuous pumping on the deBoer bulb during deposition, thus some N can be tolerated in the feed. The presence of N in the feed is due to the difficulty of sufficiently outgassing the feed mix and of maintaining low pressures during the arc melting reaction because of the large quantities of gases that must be handled. Laboratory iodination tests were developed for testing the feed. Examination of the feed mix was made by measuring the outgassing. The feed to the bulb was studied by wet chemical analysis, spectrographic analysis, x-ray diffraction as well as by the conditions of metallurgical production. A cost estimate based on the data obtained, indicated that the costs for the new process would probably be higher than those for the Kroll process. (auth)

**11160** AECU-4068
Illinois Inst. of Tech., Chicago. Armour Research Foundation.
DETERMINATION OF THE Zr CORNER OF THE Zr-Fe-Sn SYSTEM AT 0.1 AND 0.2% OXYGEN LEVELS. Final Report [for] December 5, 1957-December 5, 1958. C. Robert Lillie. Jan. 21, 1959. 58p. Project No. B-139. For Westinghouse Electric Corp. Bettis Atomic Power Div. Contract AT-11-1-GEN-14, Subcontract 73-(14-3634). $9.30(ph), $3.60 (mf) OTS.

The effect of adding 0.1 to 0.2% oxygen on phase relationships in the Zr-Fe-Sn system in a limited range of dilute alloys was studied. Iron content ranged from 0 to 1%, and tin content from 0 to 2%. In order to maintain alloy purity, hafnium-free Grade 1 iodide zirconium was used either as bar or after electron bombardment melting; the iron and tin, as well as the $ZrO_2$, were also of high purity. After suitable pretreatment, 48 arc-melted alloys at each of the oxygen levels were heat treated at 50 intervals over the temperature range of 760° to 1010°C. Phase relationships were delineated for each temperature level, based on the structures revealed by metallographic examination. It is of both theoretical and practical interest to learn that oxygen stabilizes not only the $\alpha$-phase in zirconium but also two intermetallic compounds, $ZrFe_2$ and the $\theta$-phase. The $\theta$-phase, which, chemically, appears to be $Zr_4Sn$ with about 8% Fe replacing zirconium, is shown to be stable at 1010, and probably also at 1100°C. (auth)

**11161** AECU-4083
Oak Ridge National Lab., Tenn.
PREFERRED ORIENTATION IN THORIUM. L. K. Jetter and C. J. McHargue. 41p. Contract [W-7405-eng-26]. (M-6312). $7.80(ph), $2.30(mf) OTS.

The deformation fiber texture of extruded Ames thorium was found to be <111>. Recrystallization occurring during the fabricating process produced <001> or <114> fiber textures. Annealing subsequent to extruding resulted in duplex <115>-<236> or <013>-<4,10,13> fiber textures in rods having <111>-<001> as-extruded textures. Multi-component textures were found in thorium sheet cold-rolled from an extruded bar. The components for a 75% reduction were $\{148\}\langle\bar{4}\bar{1}1\rangle$, $\{011\}\langle\bar{3}\bar{2}2\rangle$, and $\{034\}\langle\bar{1}00\rangle$; whereas the components for a 95% reduction were near $\{113\}\langle\bar{2}\bar{1}1\rangle$, near $\{011\}\langle\bar{2}\bar{1}1\rangle$, and $\{011\}\langle\bar{1}00\rangle$. The annealing texture for thorium sheet reduced 75% was $\{017\ \langle\bar{1}00\rangle$ which is 8° from the "cube" texture, and that for a 95% prior reduction was $\{001\}\langle\bar{1}00\rangle$, the "cube" texture. (auth)

**11162** AECU-4084
Knolls Atomic Power Lab., Schenectady, N. Y.
CORROSION PROBLEMS IN NUCLEAR POWER PLANTS COOLED WITH PRESSURIZED WATER. R. F. Koenig. [1956]. 14p. Contract W-31-109-Eng-52. (M-5973). $3.30(ph), $2.40(mf) OTS.

Starting with a simplified flow sheet, the general arrangement of pressurized water reactors is presented to provide a basis for discussing the corrosion problems, the reactor proper, the primary coolant system external to the reactor, and the secondary or steam system. Effects of corrosion are emphasized, using conventional corrosion problems as a reference for comparison. The role of induced radioactivity on the secondary effects of corrosion is explored, primarily from the standpoint of accessibility for maintenance. Also covered is the potential fouling of heat transfer surfaces by deposited corrosion products. (auth)

**11163** AERE-ED/R-1872
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
THE EMBEDMENT OF ABRASIVE IN LAPPED SURFACES. K. J. Williams. Feb. 3, 1956. 23p.

The embedment of lapping abrasive in materials being hand lapped with abrasive held in suspension in a fluid is discussed. It has been determined by employing techniques using radio-active silicon carbide that considerable amounts of abrasive are retained in the lapped surface. (auth)

**11164** AERE-M/M-98
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
THE HOT HARDNESS TESTING OF ZIRCONIUM AND SOME OF ITS ALLOYS AT TEMPERATURES UP TO 800°C. R. C. Burnett. July 1955. 12p.

Hot hardness curves were prepared for various grades of zirconium and some zirconium alloys at room temperature to 800°C. No peaks or plateaus were observed in the curves, and the results bear no relation to the creep properties of these materials. It is concluded that hot hardness does not provide a useful sorting test for creep-resistant alloys of zirconium. (auth)

**11165** AERE-M/R-1669A
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
THE RESISTANCE OF BINARY ALUMINIUM ALLOYS TO CORROSION BY WATER AT HIGH TEMPERATURES AND PRESSURES. R. A. U. Huddle and N. J. M. Wilkins. May 2, 1956. 23p.

As part of the development of an aluminum alloy resistant to corrosion by water at high temperature, a number of high-purity base binary alloys were exposed to demineralized water (pH 6 to 7) at temperatures from 125 to 300°C. Aluminum–nickel alloys (2.5% nickel) show outstanding resistance at 300°C and alloys containing iron, copper, cobalt, and titanium in amounts $\geq 0.5$ and 2.5% molybdenum are also resistant above 200°C. The results are discussed in relation to the mechanism of failure of aluminum under these conditions. Preliminary work on several alloys that have been developed on the basis of these results is mentioned. (auth)

**11166** APEX-464
General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.
ANALYSIS OF BEARING MATERIALS FOR ELEVATED-TEMPERATURE APPLICATION. J. P. Denny. Aug. 1957. 32p. Contracts AF33(600)-38062 and AT(11-1)-171. $1.25(OTS).

Promising areas of investigation are specified for the development of bearing materials which will operate in air at elevated temperatures. A discussion of physical and chemical properties of bearing materials and of basic principles to be considered in this development is followed by recommendations. Mutual insolubility of mating materials should lead to little or no bonding across the bearing interface with concurrent gains in friction and wear performance. Mating materials which form oxides with a degree of liquid immiscibility as well as solid immiscibility are attractive. Various metal-glass composites can be considered for elevated-temperature bearing application, with included glass particles designed to serve as the lubricant at elevated temperatures. Other promising areas of investigation include internal oxidation, external oxidation, infiltration, and the production of composites containing decomposible oxides. (auth)

**11167** CF-57-6-72
Oak Ridge National Lab., Tenn.
DYNAMIC CORROSION SCREENING TESTS ON INCONEL AND NICKEL IN $NaCl-MgCl_2-UCl_3$ BATH. D. H. Jansen. June 19, 1957. Decl. Feb. 20, 1959. 8p. Contract W-7405-eng-26. $1.80(ph), $1.80(mf) OTS.

Nickel is more susceptible to mass transfer in a 100-hr nonisothermal dynamic corrosion system than is Inconel when exposed to a $NaCl-MgCl_2-UCl_3$ (50.0–33.3–16.0 mole %) bath at a hot zone temperature of 1800°F. No nickel mass transfer was observed in a 500-hr test at 1350°F, but Inconel showed some attack under these conditions. Inconel mass transfer was observed in both tests, being more severe at the higher temperature. On the bases of these preliminary tests, it appears that nickel is a more satisfactory container than Inconel for the chloride bath at temperatures in the region of 1350°F. Chromium is more susceptible to selective leaching from Inconel at 1800°F during a short 100-hr test (0.26% Cr in bath) than in a 500-hr test ($< 0.001$% Cr in bath) at a lower temperature (1350°F). (auth)

**11168** CF-59-1-137
Oak Ridge National Lab., Tenn.
REVIEW OF THE MAXIMUM ALLOWABLE CHLORIDE CONCENTRATION IN THE PROPOSED DAREX PILOT PLANT PRODUCT. J. M. Holmes. Jan. 15, 1959. 7p. $1.80(ph), $1.80(mf) OTS.

A review of data on the effects of chlorides in nitric acid solutions upon stainless steel indicates that the proposed maximum chloride specification of 350 ppm chloride in the Darex Pilot Plant product is reasonable. (auth)

**11169** DPST-54-193
Du Pont de Nemours (E.I.) & Co. Savannah River Lab., Augusta, Ga.
ULTRASONIC DETERMINATION OF URANIUM GRAIN SIZE. D. L. Douglass. Feb. 26, 1954. Decl. Apr. 14, 1959. 5p. $1.80(ph), $1.80(mf) OTS.

The method of ultrasonic determination of uranium grain size consists of introducing a beam of ultrasound into the metal being investigated by means of a quartz transducer. The same transducer serves both to send a pulse of ultrasound and to receive the echo. If a frequency is selected so that the ratio of the wave length of the sound to the grain size is less than 10:1, sufficient attenuation of the sound occurs in the larger grains to yield a quantitative estimate of grain size. To apply the method to a specific material, the frequency of the Reflectoscope is adjusted to give clearly defined back reflections. The number of back reflections is counted and plotted against the actual grain size, determined metallographically, to give a calibration curve. Alpha-rolled uranium, having an average grain size of about 60 $\mu$, showed twelve or more back reflections, whereas beta-treated uranium showed one or two back reflections. The test is sensitive to variation of sample thickness;

therefore, the calibration curve was determined for specimens having the same thickness, 180 mils. (auth)

**11170** HW-49558
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
PROGRESS IN THE TECHNIQUE OF ROTO ARC WELDING. J. C. Tverberg. Apr. 2, 1957. Decl. Mar. 6, 1959. 16p. Contract W-31-109-Eng-52. $3.30(ph), $2.40(mf) OTS.

Investigations at Hanford were concerned with the closure of Standard Production Al—Si bonded fuel elements. Two types of welds were perfected, the first was a dome shaped weld similar to those produced at Argonne National Laboratory, the other was a single bead weld similar to those of the Heliarc welding process. The status of the Roto Arc welding program and indications of future development are shown. (auth)

**11171** IGR-R/R-303
United Kingdom Atomic Energy Authority. Industrial Group H. Q., Risley, Lancs, England.
THORIUM DATA MANUAL. E. L. Francis, comp. 1958. 29p. $1.33(BIS).

This manual is a compilation of data on the physical, mechanical, chemical, and irradiation properties of Th. (W.L.H.)

**11172** IGR-R/R-306
United Kingdom Atomic Energy Authority. Industrial Group H.Q., Risley, Lancs, England.
VANADIUM DATA MANUAL. E. L. Francis, comp. 1958. 21p. $1.12(BIS).

A compilation of the best available unclassified data on the physical, mechanical, and chemical properties of vanadium is presented. A list of references is appended. (J.R.D.)

**11173** KAPL-2000-5
Knolls Atomic Power Lab., Schenectady, N. Y.
REACTOR TECHNOLOGY REPORT NO. 8. METALLURGY. Mar. 1959. 214p. Contract W-31-109-Eng-52. $3.50(OTS).

Fuels. The formation of rare gases resulting from the fission of U and the resulting swelling of the fuel element or catastrophic volume increase are discussed mathematically. The mechanical behavior of fuel materials during reactor irradiation is discussed. A discussion is presented on a review of irradiation effects in highly enriched fuel elements and their net engineering significance, methods of reporting performance data which are applicable to all types of solid fuel, and some performance data on Zr—U alloy fuel and the relation of these data to similar data for other highly enriched fuels. The effect of transients and longer time anneals on irradiated U—Zr alloys is reported. Several compositions within the $UO_2$—$CeO_2$ system have been studied for possible application as ceramic fuel in nuclear reactors. Controls. The effect of temperature on the volume and structure stability of irradiated B-containing materials is presented. The technology and performance of Ag—In—Cd alloy control rod materials are reported. Data are presented on the attempts to improve the strength of Ag—In—Cd alloys. The fabrication of $B_4C$—Zircaloy-2 dispersion samples by hot coextrusion is described. Fabrication procedures are presented for metallographic specimens containing $B_4C$ dispersed in Zircaloy-2. Preliminary results of irradiation tests on $B_4C$, $B_4C$—$Al_2O_3$, and $B_4C$—Zircaloy-2 are presented. Structural Materials. The susceptibility of AISI-410 steel to stress-corrosion cracking in high-temperature, high-purity water is reported. The practicality of Cr plating for corrosion protection in high-temperature, high-purity water is discussed. The cracking in type 347 stainless steel tubing has been investigated. The corrosion of Inconel by high-purity water was investigated. The absorption of hydrogen and its effects on the properties of Zr and Zr alloys are presented. The habit plane for hydride precipitation in Zr and U—Zr alloys is presented. The modulus of elasticity and thermal expansion of Zircaloy-2 between room temperature and 1000°F are reported. The tensile behavior of Zircaloy-2 as a function of heat treatment is discussed. The effect of neutron irradiation on the room-temperature tensile properties of Zircaloy-3 is reported. Process Metallurgy. Various processes were examined for producing Zircaloy powder. A comparison is presented of cathodic discharge and chemical etching and the use of replication techniques for metallographic samples. The ultrasonic bond testing of narrow ligaments is reported. The joining of Al tubes with limited internal constriction in the weld areas is presented. (W.L.H.)

**11174** KAPL-M-RXS-1
Knolls Atomic Power Lab., Schenectady, N. Y.
CRITICAL VELOCITY OF "ZERO SHEAR" SINGLE FUEL PLATES. R. J. Simon. Nov. 10, 1958. 14p. Contract W-31-109-Eng-52. $3.30(ph), $2.40(mf) OTS.

Tests were conducted in an attempt to check D. R. Miller's method of computing critical velocities for a flat plate assembly assuming fluid properties for the fuel. If fluid properties are assumed for the fuel, it is necessary to assume the fuel cannot transmit shear loadings and is limited to compressive load transmission only. It is concluded that the test results and predicted results agree reasonably well, and until more test data are available, Miller's method of predicting collapse velocities of flat plate subassemblies will give values of collapse velocities that are the minimum values at which collapse can be expected to occur. (auth)

**11175** MND-E-1751
Martin Co. Nuclear Div., Baltimore.
ERDL CRITICAL EXPERIMENT, TYPE F FUEL PLATES. Task 103, Phase I. C. Richmond and L. Stevens. Feb. 1959. 16p. Contract SCH-58-70. $3.30(ph), $2.40(mf) OTS.

The design, specification, and fabrication history for U-bearing plates to be used in conducting critical experiments are described. (W.L.H.)

**11176** NAA-SR-Memo-915
North American Aviation, Inc., [Downey, Calif.]
A NEW SRE FUEL SLUG PRELIMINARY DESIGN FOR HIGHER TOTAL REACTOR POWER. B. R. Hayward. Mar. 8, 1954. Decl. Nov. 6, 1958. 8p. $1.80(ph), $1.80(mf) OTS.

A small change in design for SRE fuel slugs is proposed to minimize dimensional instability problems associated with two-phase temperature conditions. It may also increase the power density by permitting a more rapid heat removal path under some conditions. The two proposed design changes are (1) to place a small hole through the long axis of each slug or (2) to place a radial slot the full length of each slug. (A.C.)

**11177** NGTE-M-259
Gt. Brit. National Gas Turbine Establishment, Farnborough, Hants, England.
TRANSIENT THERMAL STRESSES IN BRITTLE CIR-

CULAR CYLINDERS. E. Glenny and P. W. H. Howe. Dec. 15, 1955. 34p.

A method of calculating the transient thermal stresses produced in brittle circular cylinders by rapid cooling was developed. The validity of the theory was tested by experiment, using high-alumina cylinders of varying diameter and a fluidized bed as the cooling medium. Preliminary tests show that the theory is substantially correct. Further experiments are necessary to determine whether the theory can be used to predict the thermal shock behavior of brittle circular cylinders in a variety of materials. (auth)

**11178** NMI-1213
Nuclear Metals, Inc., Concord, Mass.
DIFFUSION OF OXYGEN IN HAFNIUM. J. Paul Pemsler. Apr. 17, 1959. 7p. Contact AT(30-1)-1565. $1.80(ph), $1.80(mf) OTS.

The diffusion of oxygen in hafnium was studied in the temperature range 500 to 620°C by observing the rates of dissolution of anodically deposited interference oxide films. The diffusion coefficient obeys the equation $D = D_0 \exp(-51{,}800/RT)$ where the value of $D_0 = 1.4$, 0.47, or 0.14 $cm^2/sec$ depending on whether the value of the saturation concentration of oxygen in hafnium is assumed to be 20, 30, or 40 at. %. (auth)

**11179** NMI-1214
Nuclear Metals, Inc., Concord, Mass.
VERSATILE STRESSING DEVICE FOR SMALL SPECIMENS. E. J. Rapperport and S. H. Gelles. Apr. 21, 1959. 9p. Contract AT(30-1)-1565. $1.80(ph), $1.80(mf) OTS.

A compact device is described that is capable of exerting finely controlled forces to stress samples in tension, compression, or bending. The device is designed so that a rectangular cross-sectioned sample may be viewed microscopically on three of its four exposed faces during the stress application. After suitable calibration, both the stress and strain in the sample may be measured in all three types of loading. (auth)

**11180** NMI-9404
Nuclear Metals, Inc., Concord, Mass.
BERYLLIUM RESEARCH AND DEVELOPMENT IN THE AREA OF COMPOSITE MATERIALS. Quarterly Progress Report to WADC for the Period October 1, 1958 to January 1, 1959. J. Greenspan, G. A. Henrikson, and A. R. Kaufmann. Mar. 20, 1959. 45p. Contract AF33(616)-5912.

Bendability as a function of bend sample width was determined for the following types of wrought Be: pressed, pressed and bi-directionally rolled to low reduction, upset, extruded and rolled in the extrusion direction, extruded and rolled in the cross direction, and sheet produced under phase II of the Be rolling program. Composites consisting of alternate strips of Be and Al in single layers were formed and tested for bend ductility. Some tensile data were obtained for the transverse direction of the Be–Al strip composite. Small samples of Be were clad by brazing to either stainless steel or titanium, then tested for bend ductility with the cladding on the tension side of the bend. Several attempts were made to clad Be with stainless steel by coextrusion. Small samples of given width and thickness were coated with Al by dipping, then tested for bend ductility for the purpose of noting any unusual changes from the bend behavior of uncoated Be. (W.L.H.)

**11181** NRL-5268
Naval Research Lab., Washington, D. C.
THE PARTITIONING OF ALLOYING ELEMENTS IN MALLEABLE IRONS. George Sandoz. Dec. 23, 1958. 28p. Projects NS 013-124 and NR 511-000.

The partitioning of a number of alloying elements between the cementite and austenite phases of irons during first-stage graphitization has been determined. For the most part, the data were obtained by chemical analyses of the cementite chemically extracted from irons quenched after selected periods at 1650°F. Spot checks of these results and some explorations of alloy distribution in the matrix were made with the electron probe microanalyzer. The results show that the elements V, Cr, Mo, and Mn (not combined with S) concentrate in the cementite phase and may further enrich in this phase during graphitization. Small but measurable amounts of the elements Si, Cu, Ni, Co, and Al are also found in the cementite phase. Sulfur dissolves partially in the cementite phase but is removed insofar as MnS is formed. The finding of significant amounts of every alloying element investigated in the cementite phase suggests that the mechanism by which alloying elements influence graphitization kinetics may involve a change in the thermodynamic stability of the cementite phase. (auth)

**11182** NRL-5285
Naval Research Lab., Washington, D. C.
FOUNDRY CHARACTERISTICS OF Mn–V–Mo. N. C. Howells and E. A. Lange. Jan. 30, 1959. 12p. Projects NS 013-124 and Nr 511-000.

Successful founding of the new Mn–V–Mo age-hardenable austenitic steels depends upon the use of special techniques with regard to melting, pouring, mold materials, and heat treatment. A typical melting procedure includes piping dry argon gas into the crucible of the induction furnace and a carbon boil for minimizing the hydrogen content of the molten metal. In experiments, castings were poured at 2800°F, using a gating system with a choke at the sprue base, an enlarged runner bar, and an ingate entering the riser. This alloy appears to be more difficult to feed than low-alloy steel, and consequent precautions should be taken in choosing the gating and riser dimension. Because of the combination of high pouring temperature required by these steels and their high manganese content, sand mixtures differing from conventional mixtures are required to prevent mold-metal reactions. Sand mixtures with a zircon sand base and containing 5% silica sand and 1% core oil as special additives promote high-quality casting surfaces. Tensile properties of the metal can be controlled by the aging phase of the heat treatment; 145,000 psi ts, 110,000 psi ys, and 12% elongation were attained with an aging treatment of 8 hours at 1300°F. (auth)

**11183** NYO-8666
Hausner (Henry H.), New York.
SLIP CASTING OF METAL POWDERS. PART III. Final Report. Henry H. Hausner. Feb. 12, 1959. 36p. Contract AT(30-1)-2131. $6.30(ph), $3.00(mf) OTS.

Reviews of work described in six previous reports and the experimental work not reported heretofore are presented. It was found that other types of metal powders, such as irregularly-shaped 316 stainless steel powder or nickel powder, can be applied to the slip casting process; however, the experimental results under this contract are not conclusive. The selection of processing variables for slip casting must be changed for each type of metal powder and probably for each variation in particle size. A comparison between the sintering behavior of slip-cast and pressure-compacted

316 stainless steel powder is presented. The test results indicate that slip cast material sinters at a faster rate than does pressure-compacted powder. The physical properties of sintered materials made by both forming methods are given. (auth)

**11184** RDB(CA)/TN-101
Gt. Brit. Capenhurst Works, Capenhurst, Ches., England.
THE USE OF INDUCTION HEATING METHODS FOR THE PRODUCTION OF VACUUM-TIGHT SILVER SOLDERED CONNECTIONS. R. J. O'Connor and M. A. MacKenzie. Sept. 24, 1953. 19p. (CTSC/P-107).

A radiofrequency induction heating method for silver soldering is described. The method is quick, simple, and produces consistently good results. Vacuum failures in the initial period were of the order of 3% and show an increasing pass rate while the average time saved per joint is of the order of 75% of that required for hand brazing. (auth)

**11185** RDB(S)/TN-2041
Gt. Brit. Springfields Works, Springfields, Lancs, England.
PARTICLE SHAPE ANALYSIS AND METALLOGRAPHIC EXAMINATION OF URANIUM POWER—REVIEW OF ITEM 2.14. M. D. Jepson. July 18, 1952. 23p.

A summary of powder examination results is presented along with a discussion of particle shape analysis technique development. The main developments of the project appear to be in examining selected and treated samples to obtain information on methods of production, or for example, storage conditions. Results are tabulated. (J.R.D.)

**11186** RISLEY-8012
Gt. Brit. Culcheth Labs., Culcheth, Lancs, England.
THE EFFECT OF DISSOLVED CHROMIUM ON THE CORROSION RATE OF TWO CHROMIUM-NICKEL-AUSTENITIC STEELS IN BOILING NITRIC ACID. A. B. McIntosh, H. N. Jones, and J. A. S. Mowat. Nov. 2, 1951. 28p.

The rate of corrosion of chromium-nickel austenitic steels in boiling 70% nitric acid is greatly influenced by the frequency with which the nitric acid is renewed, the ratio of specimen surface area to volume of nitric acid, and the type of condenser employed. It is shown that these factors all operate by modifying the concentration of hexavalent chromium which tends to build up in the corroding solution and rapidly accelerates corrosion. The presence of hexavalent chromium can easily be prevented by ensuring the presence of nitrogen peroxide thereby decreasing the corrosion rate, and improving the deviation of results in the boiling nitric acid test. A suggested mechanism for the formation of hexavalent chromium is put forward, and the effect on the electrode potential of the specimen in the acid is demonstrated. (auth)

**11187** UCRL-5513
Beryllium Corp., Reading, Penna.
A STUDY OF FABRICATING BERYLLIA BY COLD COMPACTION AND EXTRUSION TECHNIQUES. Theodore M. Harkulich and Kenneth B. Highbie. July 1958. 47p. For University of California Radiation Lab. $9.30(ph), $3.60(mf) OTS.

Fabrication methods aimed at producing high-density beryllia shapes more economically were investigated. Cold compaction followed by sintering was studied as well as extrusion by ceramic techniques with subsequent sintering. The extruded shapes and cold compacts were dried and sintered at a temperature just below recrystallization. The effects of some variables on densification, shrinkage, and surface quality of the sintered shapes were evaluated. (J.R.D.)

**11188** WADC-TR-58-152(Suppl. 1)
Illinois Inst. of Tech., Chicago. Armour Research Foundation.
STUDY OF THE MECHANISM OF FAILURE OF ROCKET MATERIALS. [Period covered]: February 1, 1957 to January 31, 1958. Yehuda Baskin and Thomas A. Greening. Oct. 28, 1958. 136p. Project title: CERAMIC AND CERMET MATERIALS. Task title: CERAMIC AND CERMET MATERIALS DEVELOPMENT. Contract AF33(616)-3925. (AD-207779).

Twenty-five different materials were evaluated as nozzle inserts in rocket motors utilizing typical solid propellants. Evaluation of each material consisted of its exposure to the high temperature sonic gas flow of solid propellant engines under conditions of high internal chamber pressure for relatively short periods. Some of the nozzle materials were incorporated in subsequent trials at various combinations of chamber pressure and duration. Unfired and fired nozzles were examined, utilizing x-ray diffraction, microscopic, chemical, metallographic, and other analytical techniques. Wear parameter data, shadowgraphs, and macrophotographs are presented. (auth)

**11189** WADC-TR-58-360(Pt. I)
Buffalo. Univ. Carbon Research Lab.
INVESTIGATION OF ELASTIC AND THERMAL PROPERTIES OF CARBON-BASE BODIES. S. Mrozowski, J. F. Andrew, J. Repetski, H. E. Strauss, and D. C. Wobschall. June 30, 1958. 66p. Project title: CERAMIC AND CERMET MATERIALS. Task title: ANP ROVER MATERIALS. Contract AF33(616)-5186. (AD-206664).

Results are presented of a first year of a program designed to study the elastic and the conductive properties of the carbon-base materials. A high precision apparatus for study of flexure and torsion deformations at room temperature with dependence on time and the applied stress was developed, and complete stress-strain hysteresis type curves obtained. Presence of creep and permanent set both increasing in proportion to the logarithm of time has been established. Furthermore, it has been found that the presence of the original extruded surface contributes to the shear but not to the Young's modulus. Noises originating from formation of cracks during the first deformation were listened to in an effort to understand the nature of creep and permanent set under these conditions. A direct determination of Poisson ratio for compression along the extrusion axis gave a result $\delta = 0.14 \pm 0.02$. The velocity of ultrasonic waves has been found to depend strongly on the density of the graphite, but not on the frequency of the waves. An apparatus for the study of heat conductivity at high temperatures (1200 to 3000°C) was constructed and operated with either an argon atmosphere or under evacuated conditions. A number of representative types of carbon materials (soft and hard carbons, and mixed composites), has been studied, and it was shown that the conductivity mainly depends on the particle type and less on the binder type used in the mix. Convection of gas contained in pores contributes to the measured over-all conductivity. No particle size dependence could be found. (auth)

**11190** WADC-TR-58-503
Illinois Inst. of Tech., Chicago. Armour Research Foundation.
GRAPHITE TECHNOLOGY. [Period covered] April 1, 1957–September 1958. S. W. Bradstreet. Sept. 15, 1958. 72p. Project No. 7308. Contract AF33(616)-5185. (AD-208324).

The two-fold purpose of this investigation has been to correlate the properties of small, multicrystalline graphite specimens with the factors believed to influence them, and to assess the probability that graphite can conform to engineering specifications. The technique of differential thermal analysis was found applicable to investigating binder pyrolysis. Three promising binder materials were selected for future work: coal-tar pitch, furfuryl alcohol, and phenolbenzaldehyde. The most illuminating properties of experimental mixtures were found to be: apparent (water immersion) density, dynamic (sonic) modulus, volume electrical resistance, and flexural strength. Measurements of modulus, strength, and thermal expansion have been carried out to temperatures exceeding the creep threshold of graphite, between 2100 and 2250°C. Solvent mixing techniques for insuring homogeneous distribution of the binder were found to improve reproducibility, in all cases some change in the rheology of the system was observed with time. Maximum density and strength in pitch-bonded coke was achieved after "aging" the mix at 125°C under partial vacuum. Maximum density consistent with good thermal shock resistance was obtained by adding Thermax to the coke flour. With 14 per cent by weight of Thermax specimens were made having densities exceeding 1.8 gm/cc with room-temperature strengths of about 2500 psi. Dynamic flexural moduli were measured for specimens heated and cooled between room temperature and 2650°C. Specimens cut from a block of commercial, impregnated, molded graphite increased 175 per cent in flexural strength when heated to 2000°C. Such heating caused a significant permanent change in dimension, modulus, and volume resistance. (auth)

**11191** WADC-TR-58-545
Horizons, Inc., Cleveland.
RESEARCH FOR COATINGS FOR PROTECTION OF NIOBIUM AGAINST OXIDATION AT ELEVATED TEMPERATURES. [Period covered] July 1, 1957 to August 31, 1958. Emanuel C. Hirokis. Sept. 12, 1958. 73p. Project title: METALLIC MATERIALS. Task title: HIGH TEMPERATURE ALLOYS. Contract AF33 (616)-5356. (AD-209914).

Nb alloys were prepared offering up to 20 fold reduction in oxidation at 2000°F compared with pure Nb. Flame sprayed and electrodeposited coatings were developed giving more complete protection for 4 to 6 hrs at 2500°F. Preparation of alloys and coatings together with test procedures and results are described for both phases. (auth)

**11192** WAL-TR-405-2/3
Watertown Arsenal Lab., Mass.
NOTCH SENSITIVITY AND RESISTANCE TO TEARING OF TITANIUM ALLOY SHEET. Stuart V. Arnold. Apr. 1959. 20p. DA Project No. 5B93-32-003. (AD-210868).

Test of titanium sheet alloys Ti–4% Al–3% Mo–1% V, Ti–5% Al–2.5% Sn, Ti–8% Al–2% Cb–1% Ta, and Ti–6% Al–4% V in gages ranging from 0.020 to 0.137" thickness using the laminated Charpy impact specimen has disclosed that fracture may occur by three modes, one brittle and two ductile, corresponding to low, intermediate and high impact energy absorption. Sheet thickness influences the mode of fracture and impact energy absorption; it is an important factor in notch sensitivity of titanium alloy sheet. (auth)

**11193** WAPD-ZH-15
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
ZIRCONIUM HIGHLIGHTS. Mar. 1959. 19p. Contract AT-11-1-GEN-14. $3.30(ph), $2.40(mf) OTS.

An investigation was initiated to determine the hydrogen pickup behavior of Zircaloy-2 during aqueous corrosion to determine whether the removal of Ni from Zircaloy-2 would result in a reduction in the amount of hydrogen pickup and to evaluate the corrosion behavior of Ni-free Zircaloy-2 in high-temperature water and steam. An investigation is being conducted to determine the effects of oxygen content varying from 100 to 10,000 ppm on the corrosion, mechanical, transformation, and fabrication characteristics of vacuum-melted Zircaloy-2. An investigation was initiated to determine the degree of contamination which would occur during welding of Zircaloy-2 with W, C, and Zr electrodes in air, in air with a He shield, and in a vacuum-tight box evacuated to 0.03 microns and back-filled with one atmosphere of He. Tensile test data are reported for vacuum-melted Zircaloy-2 ingot strip at room temperature and 600°F. A study of the effects of machining variables on the corrosion resistance of Zircaloy-2 surfaces was conducted. The effect of oxygen on the precipitation of $ZrFe_2$ in Zr–Fe–Sn ternary alloys was determined during studies of the Sn–Fe–Zr ternary system with oxygen levels of 0.05, 0.1, and 0.15%. (For preceding period see WAPD-ZH-14.) (W.L.H.)

**11194** AEC-tr-3577
THE TECHNOLOGY AND PROPERTIES OF BERYLLIUM. Goran Lagerberg. Translated for Oak Ridge National Lab. from a report of the AB Atomenergi, Stockholm, 1958. 55p. $9.30(ph), $3.60(mf) JCL or LC.

The literature study gives a survey of the technology and characteristics of beryllium, especially in regard to the possibilities for using it as cladding material in gas-cooled reactors. The physical characteristics, metallurgy, workability, mechanical characteristics, welding, and corrosion of beryllium are discussed. Also discussed are special methods for the fabrication of cladding tubes, changes in beryllium due to neutron radiation, and health risks involved in working with beryllium. (auth)

**11195** AEC-tr-3629
ON THE HARDNESS OF REFRACTORY CARBIDES. G. A. Meerson and Ya. (Ia.) S. Umanskii. Translated for Los Alamos Scientific Lab. from Izvest. Sektora Fiz. Khim. Anal., Inst. Obshchei Neorg. Khim., Akad. Nauk S.S.S.R. 22, 104-10(1953). 7p. $1.80(ph), $1.80(mf) JCL or LC.

The hardness of refractory metal carbides was investigated. It was concluded that at present no quantitative relationship can be established between the magnitude of the hardness of these materials and their structure; however, some factors are presented which may serve as reasons for the hardness. It is pointed out that the considerations which were applied in the case of carbides may also find application in other hard metalloid compounds of refractory metal types which produce interstitial phases, such as the nitrides. (J.R.D.)

**11196** AERE-Trans-11/3/5/1150
INFLUENCE OF RECRYSTALLIZATION ON DAMPING AND SHEAR MODULUS OF TUNGSTEN WIRES. W. Schilling and R. Haspel. Translated by R. C. Murray (U.K.A.E.A. Atomic Energy Research Establishment) from Z. Metallk. 48, 32-4(1957). 8p. (Figures omitted.) $1.80(ph), $1.80(mf) JCL or LC.

Tungsten wires, obtained by sintering with subsequent hammering and drawing, were used in determinations of damping and shear modulus. One wire contained additions of alkali silicate while the other was made with thoria additions. In the absence of thoria, damping and shear modulus change markedly in the recrystallization temperature range. Thoria suppresses secondary recrystallization, resulting in a sudden change in damping and shear modulus at about 2200°K. In the temperature range of primary recrystallization a small drop of damping occurs in both wires through grain coarsening. Calculations of activation energies for relaxation by viscosity are included. (J.R.D.)

**11197** CEA-tr-R-477
NOUVELLES TENDANCES DANS LE DÉVELOPPEMENT DE LA METALLOGRAPHIE A HAUTE TEMPERATURE. (New Tendencies in the Development of High-Temperature Metallography.) M. G. Lozinskii (Lozinsky). Translated into French from Met. i Obrabotka Metal., No. 11, 18-42(1957). 61p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 7283.

**11198** CEA-tr-R-604
PARTICULARITES DU PROCESSUS DE RUPTURE PAR FATIGUE DES ALLIAGES A HAUTE TEMPERATURE. (Peculiarities of Fatigue Rupture Process of Alloys at High Temperatures.) V. A. Parfenov. Translated into French from Met. i Obrabotka Metal., No. 2, 19-22 (1958). 9p.

An analysis was made of the experimental results of various investigators on the fatigue rupture of alloys at high temperatures. The analysis gave some generalizations on the endurance of alloys with high heat resistance at temperatures below 0.7 $T_{abs}$ of fusion. The mechanism of the rupture process is described, and the effects of thermal cycling are discussed. A nickel–chromium–titanium alloy is discussed as an example. (J.S.R.)

**11199** CEA-tr-R-609
MECANISME DE LA CORROSION DES METAUX DANS DES FENTES ETROITES. IV. CORROSION DES ACIERS INOXYDABLES. (Mechanism of the Corrosion of Metals in Narrow Fissures. IV. Corrosion of Stainless Steel.) I. K. Marchakov and I. I. Rozenfel'd (Rosenfeld). Translated into French from Zhur. Fiz. Khim. 32, 66-72(1958). 15p.

A study of the corrosion and electrochemical behavior of chrome steel with narrow cracks in 0.5 N NaCl solution is described. The passive state of steel with 13 to 17% Cr is broken at the cracks leading to the formation of corrosion pits. When there is contact with the steel, immersed in the electrolyte, the corrosion depth inside the crack increases because of formation of active-passive elements. A mechanism is offered for this. (T.R.H.)

**11200** IGRL-T/R-76
THE ASSEMBLY OF ALUMINIUM IN CONTACT WITH OTHER METALS. E. Zurbrugg. Translated by E. G. Peters (U.K.A.E.A., Risley) from Aluminium Suisse 4, 122-7(1955). 9p.

The electrochemical behavior of Al in contact with another metal is considered. It is pointed out that assembly of Al in direct contact with a more noble metal is permissible as long as the assembly does not come in contact with a liquid which conducts electricity. A way to forestall galvanic Al corrosion is to prevent its contact with a more noble metal; however, this method is not expedient in many cases. Other methods of corrosion prevention such as the insertion of resin insulators and anodization are discussed. (J.R.D.)

**11201** NP-tr-230
SPECTRAL DETERMINATION OF CERTAIN METALLOIDS. N. S. Sventitskii. Translated for Lincoln Lab., MIT from Izvest. Akad. Nauk S.S.S.R., Ser. Fiz. 11, 319-25(1947). 11p.

The determination of P, S, and C in steel, in cast iron, and in other metals and alloys by spectrographic methods is presented. (W.L.H.)

**11202** SCL-T-236
ACCELERATION OF SINTERING (FRITTING, CALCINING) IN A SINGLE PHASE. CONSIDERATIONS ON THE MODE OF ACTION OF MINOR ADDITIVES. (Accélération du Frittage en Phase Unique. Considérations sur le Mode d'Action des Additions Mineures.) Serge Tacvorian. Translated by Marcel I. Weinreich (Sandia Corp.) from Compt. rend. 234, 2363-5(1952). 5p. $1.80(ph), $1.80(mf) JCL or LC.

The relations existing between the conditions of sintering and equilibrium diagrams were studied. It was concluded that trace impurities can play a decisive role in sintering, resulting in difficulty of giving a positive interpretation to experiments in which an unsuspected impurity plays a part. The elimination of the liquid phase and substitution of an accelerating additive offers the possibility of making improvement in the current procedure of fritting. (J.R.D.)

**11203**
NEW DETERMINATION OF THE INTERGRANULAR SELF-DIFFUSION CONSTANTS OF CUBIC CENTERED IRON. Claude Leymonie, Yves Adda, Alexis Kirianenko, and Paul Lacombe. Compt. rend. 248, 1512-15(1959) Mar. 9. (In French)

The application of the sectioning method to polycrystals of iron covered with radioactive iron and submitted to diffusion treatments between 580 and 616°C permitted the phenomenon of intergranular self-diffusion to be characterized by the relation $D_J\delta = 6.5 \times 10^{-7} \exp(-40{,}000/RT)$, where $\delta$ is the length of the grain boundary. This relation justifies the use of the more rapid method described earlier (Compt. rend. 246, 2614 (1958)). (tr-auth)

**11204**
THE PROPERTIES OF PURE IRON CHARGED WITH CATHODIC HYDROGEN IN THE PRESENCE OF SULFUR, ARSENIC, AND ANTIMONY. Simone Besnard, Christian Messager, and Jean Talbot (Centre National de la Recherche Scientifique, Paris). Compt. rend. 248, 1516-19(1959) Mar. 9. (In French)

Experimental results showing the diffusion of some impurities into iron during charging with cathodic hydrogen are presented. Optical micrography and electron microscopic study indicates the existence of an intergranular precipitation which makes the metal brittle. (tr-auth)

**11205**

COMPARATIVE EVALUATION OF SOME METHODS OF DETERMINATION OF BERYLLIUM AND ITS COMPOUNDS APPLICABLE TO THE ANALYSIS OF AIR. M. S. Bykhovskaya. Gigiena Truda i Professional. Zabolevaniya No. 6, 49-53(1957). (Translated from Referat. Zhur. Met. No. 8, 1958, p. 275.)

A review is presented of colorimetric, fluorescent, and spectrographic methods of determination of the amounts of Be in various substances. The use of trilon B for the elimination of the effect of the interfering cations and the separation of impurities with the aid of paper-chromatography separation was investigated. The most sensitive of the methods is the fluorescent one with morin, which forms an intracomplex compound with a yellowish-green fluorescence under ultraviolet rays. Sulfates, chlorides, and nitrates decrease the intensity of the fluorescences. The minimum determinable amount of Be is 0.01 $\gamma$ in aqueous solutions and 0.05 $\gamma$ in solutions of neutralized acids. Of the colorimetric methods the best is the one with beryllon P. The minimum determinable amount of Be is 0.5 $\gamma$. The spectrographic method of determination of Be has possibilities. The paper chromatography separation method can be used as a semiquantitative one for the determination of Be in the presence of Ca, Mg, Fe, Mn, and Al.

**11206**

AN INVESTIGATION OF THE EFFECT OF SMALL QUANTITIES OF ADDITIVES ON THE KINETICS OF AGING OF ALLOYS. V. I. Arkharov, A. I. Moiseyev, and I. P. Polikarpova. Issledovaniya po Zharoproch. Splavam Akad. Nauk S.S.S.R. 2, 92-7(1957). (Translated from Referat. Zhur. Met. No. 8, 1958, p.213.)

Hardness measurements were employed in an investigation dealing with the combined accelerating and retarding effect of additives on the early stages of the aging process of Cu alloys containing up to 6% Ag. Sb (up to 0.5%) and Be (up to 0.3%) served as the accelerating and retarding additives. (W.D.M.)

**11207**

ON THE COLLOIDAL STATE OF THE SOLID IN METALLIC SYSTEMS OF TWO PHASE ALLOYS. V. M. Glazov and V. N. Vigdorovich (Baikov Inst. of Metallurgy, Academy of Sciences, U.S.S.R.). Kolloid. Zhur. 21, 18-24(1959) Jan.-Feb. (In Russian)

Based on microhardness studies of crystals of two phase solid solution alloys of a number of binary systems, the transitions of heterogenized crystals of the solid solution from a metastable to a stable state was examined from a kinetic standpoint. The transition was shown to occur in two stages. The phenomenon is treated on the basis of the colloidal state of crystals of the solid. (auth)

**11208**

EXTRUDING METAL POWDERS. Eric Gregory (Sintercast Corp. of America, Yonkers, N. Y.). Metal Progr. 75, No. 4, 113-16; 150-2; 154; 156; 158 (1959) Apr.

Molybdenum is handicapped by its low ductility, particularly in weldments, at room temperature. Limited work indicates inert-gas-shielded consumable-electrode welding may be best applied to welding of thick Mo plate, with the tungsten-arc method better for sheet up to $^1/_8$ in. thick. Arc stability and metal transfer were improved most with direct current, straight polarity, helium-shielded consumable electrodes coated with electron emitting compounds using high-current densities. (W.L.H.)

**11209**

THE CORROSION OF METALS IN SALT WATER. Y. Aoyama (Railway Technical Research Inst., Tokyo). Naturwissenschaften 46, 107(1959). (In German)

The corrosion products of magnesium placed in water containing chloride ions were analyzed spectrographically and were shown to be basic magnesium chloride. Magnesium powder in a 0.1 N solution of potassium chloride gave the same corrosion products. Basic chloride was also detected on copper, iron, lead, and zinc corroded in salt water. It is suggested that metal corrosion in salt water originates through the formation of basic metal chlorides. (J.S.R.)

**11210**

PROCESS FOR THE MANUFACTURE OF FUEL ELEMENTS FOR NUCLEAR REACTORS. Deutsche Gold- und Siber-Scheideanstalt vorm. Roessler (Germany). British Patent 800,420. Nuclear Eng. 4, 188(1959) Apr.

In order to facilitate heat transfer between the fuel and the body of the can, it is proposed to fill the free space inside the loaded can with pure magnesium or an alloy of high magnesium content. A can, suitable for the purpose, is described. The tube, substantially longer than the fuel rod, is permanently closed at one end and has an opening of about 0.5 mm dia. at the other. In applying the method, the can is evacuated after loading and subsequently the magnesium, in the molten state, is fed into the can through the opening under the action of compressed inert gas. Finally, the opening is sealed off, either by welding or by means of a plug.

**11211**

SEPARATING AND PURIFYING ZIRCONIUM AND HAFNIUM. Commissariat á l'Energie Atomique (France). British Patent 800,426. Nuclear Eng. 4, 188(1959) Apr.

An aqueous and acid solid solution is formed from the ore containing zirconium and hafnium. This solution is treated with a solvent, such as alkyl phosphate or acetate, or an alkyl-aryl phosphate or acetate, which permits extraction of the zirconium without affecting the hafnium in the solution.

**11212**

FUEL ELEMENTS FOR NUCLEAR REACTORS. H. M. Finniston and U. K. Atomic Energy Authority. British Patent 800,671. Nuclear Eng. 4, 188(1959) Apr.

The element described consists of a settled slurry of finely divided fuel or a suspension of the same in liquid metal, contained in a double-walled stainless steel tube, the walls of the latter being some $^1/_{16}$-$^1/_{10}$ in. apart. The carrier metal should have a melting point below the operational temperature of the reactor, i.e., below 600°C. Suitable metals are: lead, sodium, and lithium. The proportion of fuel to metal should be of the order of 34 : 66.

**11213**

FUEL FOR NUCLEAR REACTORS AND PROCESS OF MAKING THE SAME. B. M. Abraham and H. E. Flotow (U.S.A.). British Patent 801,288. Nuclear Eng. 4, 188 (1959) Apr.

Uranium or suitable uranium compounds such as the dioxide, nitride, silicide, and carbide are suspended in liquid sodium heated above melting point or a sodium-potassium mixture. The fuel may represent 20% of the total volume; the fuel particles should not be larger than

5 microns, a size which can be obtained by grinding the material in a ball mill for 48 hours using toluene as lubricant.

**11214**

PRODUCTION OF URANIUM DIOXIDE MASSES. P. Murray and U. K. Atomic Energy Authority. British Patent 801,381. Nuclear Eng. 4, 188(1959) Apr.

Uranium dioxide masses of high bulk density are produced by sintering cold-pressed masses of $UO_{2.09}$ to $UO_{2.15}$ in an inert atmosphere at 1200 to 1500°C or higher, for periods ranging from $\frac{1}{2}$ hour to 2 hours.

**11215**

A NOTE ON THE ELASTIC CONSTANTS OF URANIUM. S. J. Rothman and E. S. Fisher (Argonne National Lab., Lemont, Ill.). Nuclear Sci. and Eng. 5, 195-6(1959) Mar.

The elastic moduli of polycrystalline uranium are calculated from single crystal data and are compared with measured values. The discrepancies between data measured at different laboratories are also discussed. (auth)

**11216**

ELASTIC CONSTANTS OF POLYCRYSTALLINE URANIUM. Henry L. Laquer (Los Alamos Scientific Lab., N. Mex.). Nuclear Sci. and Eng. 5, 197-9(1959) Mar.

Exception is taken to the conclusion of Rothman and Fisher that the elastic properties of uranium strongly quenched from the $\beta$ phase are characteristic of the polycrystalline metal. Sound velocities and elastic constants of uranium are tabulated to support the exception. (A.C.)

**11217**

AN EVALUATION OF $UO_2$ DISPERSIONS. E. N. Mazza and W. R. Weinberger (Sylvania-Corning Nuclear Corp., Bayside, N. Y.). Nucleonics 17, No. 4, 137-9(1959) Apr.

The preparation of $UO_2$ for incorporation into dispersion-type fuel elements and fuel element fabrication are discussed. (T.R.H.)

**11218**

THE EFFECT OF PRELIMINARY PLASTIC DEFORMATION ON MARTENSITE TRANSFORMATION IN Fe–Cr–Ni ALLOYS. G. V. Kurdyumov, O. P. Maksimova, A. I. Nikonorova, Z. D. Pavlenko, and A. M. Yampol'skii. Sbornik Trudov Inst. Metalloved. i Fiz. Metal. Tsentral. Nauch. Issledovatel. Inst. Chernoĭ Met. 5, 41-55(1958). (Translated from Referat. Zhur. Met. No. 8, 1958, p. 210.)

Investigations were performed in order to evaluate the effect of plastic deformation and subsequent heating on processes of martensite transformation during cooling. It was established that, depending on the conditions of plastic deformation and annealing procedures, there may be an activating or retarding effect on the martensite transformation. (W.D.M.)

**11219**

THE IRRADIATION STABILITY OF LOW WT PCT URANIUM–ZIRCONIUM ALLOYS. A. H. Willis (Knolls Atomic Power Lab., Schenectady, N. Y.). Trans. Met. Soc. AIME 215, 245-51(1959) Apr.

The results of an exploratory study on 18.6, 22, and 40 wt. % uranium–zirconium alloys are presented. (auth)

**11220**

ON THE NICKEL-RICH END OF THE ZIRCONIUM–NICKEL PHASE DIAGRAM. D. Kramer (Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.). Trans. Met. Soc. AIME 215, 256-8(1959) Apr.

A brief report is presented on the phase studies of nickel–zirconium alloys from 0 to 25 at. % zirconium by x-ray and metallographic methods. (J.E.D.)

**11221**

QUANTITATIVE SPECTROSCOPIC DETERMINATION OF NIOBIUM IN TITANIUM AND ZIRCONIUM MINERALS. L. S. Borodin. Trudy Inst. Mineral. Geokhim. i Kristallokhim. Redkikh Elementov Akad. Nauk SSSR No. 1, 182-7(1957). (Translated from Referat. Zhur. Met. No. 8, 1958, p. 270.)

The methods for the preparation of standards for the determination of Nb in eudialite, sphene, rincolite, astrophyllite, and lamprophyllite are described in detail. The conditions of the taking of an exposure are: Test sample 10 to 15 mg, upper electrode ground to a wedge-shaped point, a crater 5 mm deep and 3 mm in diameter drilled in the lower electrode, time of complete evaporation of specimen 4–5 min with a 10-amp current. Calibration curves were plotted according to 3–4 standard samples. The spectrophotometry was conducted according to the lines of Nb 2671.9 and 2716.6 angstrom. The results of the determination of Nb in 20 specimens parallel with the determination of Nb in them by the chemical method are adduced. The average magnitude of deviation from the chemical analysis consisted of ±13% with an Nb content of 0.15 to 5.0%.

**11222**

PRODUCING A EUTECTIC POTASSIUM–SODIUM ALLOY. F. S. Maron and Z. P. Uspenskaya. Trudy Ural. Nauch. Issledovatel. Khim. Inst. No. 5, 91-8 (1957). (Translated from Referat. Zhur. Met. No. 8, 1958, p. 74.)

An investigation was made of a method of producing a eutectic K–Na alloy without organic additions. The process is conducted in airtight equipment consisting of a retort 180 mm high, 75 mm in diameter, and 2 mm in wall thickness. Before the experiment, pieces of Na and K were freed of kerosene and oil by filter-paper pressure. The surface film of oxide was then cut away, and samples calculated to contain 22 weight % Na and 78 weight % K were then prepared in a dry, closed box. The K was placed on the bottom of the retorts, and the Na atop the piece of K. The metal was heated to 70 to 80°C, stirred, and poured into the receiver after cooling to room temperature. To separate the films from the alloy, the metal was filtered through an Fe screen with ~1-mm mesh, the screen being pulled over a tripod installed in the retort. The K and Na were placed on the screen. With heating the metal melted and flowed onto the bottom. The resultant alloy cast to a mirror-smooth surface. Airtight containers were developed and tested for the production, storage, and transportation of the K-Na alloy.

**11223**

ADSORPTION OF BARIUM ATOMS AND BARIUM OXIDE MOLECULES ON TUNGSTEN. [PART] I. Yu. S. Vedula and V. M. Gavrilyuk (Inst. of Physics, Academy of Sciences, Ukrainian S.S.R.). Ukrain. Fiz. Zhur. 3, 632-50(1958) Sept.-Oct. (In Ukrainian)

The heats of adsorption of Ba and BaO on W surfaces were studied at 300 to 700°K and 300 to 1000°K, respectively. The experiments determined the isobars and isotherms and other characteristics of adsorption and desorption. (R.V.J.)

**11224**

ON THE NATURE OF THE SHORT RANGE ORDER OF ALLOYS OF THE Fe–Cr SYSTEM. P. A. Suprunenko (Kiev State Univ.). Ukrain. Fiz. Zhur. 3, 673-7(1958) Sept.-Oct. (In Ukrainian)

It is shown that a preliminary high-temperature annealing of an alloy of the Fe–Cr system with a Cr content of 45, 47, or 49 at. % raises the Curie temperature and specific conductivity throughout the temperature region. The results obtained are discussed, proceeding from the assumption of the formation of a negative short range order. (auth)

**11225**

DENSITY OF DISLOCATIONS ARISING DURING NICKEL, ALUMINUM, AND SILVER DEFORMATION. S. D. Gertsriken and N. N. Novikov (Kiev State Univ.). Ukrain. Fiz. Zhur. 3, 695-6(1958) Sept.-Oct. (In Ukrainian)

The dislocation density in Ni, Al, and Ag arising in torsion deformation was studied by dilatometric methods. The data for 99.99% Ni, 99.995% Al, and 99.99% Ag are plotted. (R.V.J.)

**11226**

PHASE TRANSFORMATIONS IN STEEL WITH ELECTROTEMPERING. V. N. Gridnev and V. I. Trefilov (Inst. of Metal Physics, Academy of Sciences, Ukrainian S.S.R.). Ukrain. Fiz. Zhur. 3, 796-801(1958) Nov.-Dec. (In Ukrainian)

Some peculiarities of phase transformations were investigated in carbon steel with electrotempering. The application of high heating rates induces considerable changes in the development of the tempering process. The first effect of tempering is displaced in the range of higher temperatures, and its temperature position does not depend upon heating rates of 100° per sec and over. This effect is connected with the exit of carbon from the martensite lattice. The second effect of the tempering is connected with the dissociation of the residual austenite. This effect is not revealed in the investigated interval of the heating rate. But progressive dissociation of the residual austenite occurs as a result of a momentary holding before cooling, especially in the middle temperature range. The third effect of tempering is revealed fairly indistinctly even when the heating rate is as high as 8000° per sec and is also displaced in the range of higher temperatures as compared with ordinary tempering. Data were obtained on the change of the coercive force and hardness of electrotempered steel. (auth)

**11227**

CERTAIN ANOMALIES IN THE ELECTRICAL RESISTANCE OF IRON–ALUMINUM ALLOYS DUE TO THE IRON CORNER. P. V. Petrenko and P. P. Kuzmenko (Kiev State Univ.). Ukrain. Fiz. Zhur. 3, 820-8(1958) Nov.-Dec. (In Ukrainian)

The dependence of resistance on the temperature and concentration was investigated for Fe–Al systems with concentrations of 16, 20, 25, 30, 35, 40, and 50 at. % Al in the temperature range 20 to 1200°C. The dependence $\rho = f(T)$ proved anomalous for all alloys. A typical feature of this dependence is that an abrupt decrease of the temperature coefficient of resistance is noted for all alloys at definite temperatures. The described anomalies, as well as a number of others for the Fe–Al system cannot be explained solely by taking into consideration the thermal factor, the ordering factors and the vanishing of ferromagnetism. The dependence of the residual resistance on the tempering temperature indicates the existence of a third factor which leads, beginning at definite temperatures, to a decrease in resistance. The nature of this factor is assumed to be due to the change in the energetic spectrum of the electrons, evidently as a result of change in the interatomic distance. (auth)

**11228**

KINETICS OF PHASE TRANSITIONS IN ALLOYS OF THE Cd–Mg SYSTEM. P. P. Kuzmenko and G. I. Kalnaya (Kiev State Univ.). Ukrain. Fiz. Zhur. 3, 829-35(1958) Nov.-Dec. (In Ukrainian)

Investigations were conducted on alloys with 20, 22, 25, 27.6, 33, 50, 66.7, 78, and 80 at. % Cd. The kinetic curves are well described by the expression $V = V_0(1-e^{-\alpha t^b})$ in the half-transition time $t_{1/2}$. A determination was made of the coefficient b which proved close to unity. The dependence of $t_{1/2}$ on (1/T) is of a linear nature, making it possible to calculate the energy of activation of the transition. Data are presented on the dependence of the activation energy on the concentration. The activation energy $E_a$ proved to be proportional to the heat of transition Q, i.e., $E_a = kQ$, where k is a constant for all alloys and equals 90. (auth)

**11229**

INVESTIGATION OF THERMAL, ELECTRICAL, AND MECHANICAL PROPERTIES OF THE COPPER ANGLE IN Cu–Be–Mn ALLOYS. V. E. Mikryukov and Chou Shi-Chan. Vestnik Moskov. Univ. Ser. Mat. Mekhan. Astron. Fiz. i Khim. 13, No. 3, 129-38 (1958). (In Russian)

A constitution diagram of Cu–Be–Mn (0.90 wt. % Be) was plotted in order to determine the physicomechanical properties of the copper angle. The most effective mechanical properties were found with 91.80% Cu, 0.90% Be, and 7.30% Mn. The electric conductivity of the copper angle was found to be small; thus the experimental magnitude of the Videman-Frants ratio is larger than the theoretical. (R.V.J.)

**11230**

ELECTRON BEAM WELDING, A NEW DEVELOPMENT FOR INDUSTRY. W. I. Steinkamp and W. L. Wyman (General Electric Co., Richland, Wash.). Welding Engr. 44, No. 4, 38-40(1959) Apr.

The principles of electron-beam welding and its advantages and applications are surveyed. Results of tests on Zircaloy-2 and Al fuel elements are discussed. (T.R.H.)

**11231**

ARGON PINCH-HITS FOR HELIUM IN ZIRCALOY-2 WELDING OPERATIONS. H. E. Soisson (Knolls Atomic Power Lab., Schenectady, N. Y.). Welding Engr. 44, No. 4, 59(1959) Apr.

Test results are cited to show that Ar may be satisfactorily substituted for He in welding Zircaloy-2. (T.R.H.)

**11232**

CONTRIBUTION TO THE ELECTRIC CONDUCTIVITY OF PURE COPPER AND THE INFLUENCE OF ADMIXTURES. Ernst Günter Hess and Franz Pawlek (Technischen Universität, Berlin). Z. Metallk. 50, 57-70(1959) Feb. (In German)

The influence of oxygen, sulfur, selenium, and tellurium on the electric resistance of pure copper is investigated. The electric conductivity is determined for the copper corner of the systems copper—iron—phosphorus and copper—iron—phosphorus—oxygen. The experiments show that the conductivity of a copper, containing iron and phosphorus, can be increased by oxygen. (auth)

**11233**

PRECIPITATION AND DISSOLVING PROCESSES IN THE COPPER—IRON SYSTEM. Volker Schumacher (Univ. of Göttingen, Ger.). Z. Metallk. 50, 81-6(1959) Feb. (In German)

Investigations of dissolution and precipitation processes in iron—copper alloys are described. Electrical resistance and thermoelectric power were measured. The results are discussed. They show that after quenching from solid solution, iron is present in a precipitated form. Particles are dissolved at aging. (auth)

**11234**

THE DISCONTINUOUS PRECIPITATION IN COPPER—INDIUM ALLOYS. Horst Böhm (Metallgesellschaft AG, Frankfurt am Main). Z. Metallk. 50, 87-93(1959) Feb. (In German)

On copper alloys with up to 15% indium, cellular precipitation was studied between 200 and 480°C. The activation energy of grain boundary diffusion depends on concentration and has values between 20 and 23 kcal/g-at. The transition from discontinuous to continuous precipitation is somewhat shifted to higher temperatures with increasing indium content. Cold working has no measurable influence on the transition temperature. (auth)

**11235**

ELECTRON MICROSCOPIC SURFACE IMPRESSIONS OF ELECTROLYTICALLY DEPOSITED METALLIC FILMS. I. COPPER FILMS WITH INCORPORATED ORGANIC IMPURITIES. Ludwig Reimer and Manfred Aust (Univ. of Müster, Ger.). Z. Metallk. 50, 101-6 (1959) Feb. (In German)

Electron microscopic pictures of electrolytically deposited copper layers are made by the platinum—carbon replica method, and the influence of different organic additions to the copper sulfate solution on the surface of the layers is studied. Experiments show this method to be very convenient for the study of electrolytic deposition. (auth)

**11236**

PROBLEM OF THE QUALITY DETERMINATION OF COPPER WIRE. Karl Robert Vassel (Forschungsinstitut für Nichteisen-Metalle, Budapest). Z. Metallk. 50, 112-17(1959) Feb. (In German)

A study was made of the problem of the determination of quality of commercially pure copper wires. There is a connection between the electric conductivity and the amount of additional elements. Some mechanical properties show strong sensitivity against deformation as well as inclusions. (auth)

**11237**

USE OF RADIOACTIVE THULIUM IN $\gamma$-DEFECTOSCOPY. V. S. Tokmakov (Central Scientific Research Inst. of Ferrous Metallurgy). Zavodskaya Lab. 24, 983-5(1958). (In Russian)

The feasibility of using $Tm^{170}$ for checking the quality of welded joints in steel products is described. (R.V.J.)

**11238**

ELECTRON MICROSCOPIC INVESTIGATION OF THE GRAIN STRUCTURE IN POWDER OR COMPACT TUNGSTEN. N. P. Vasil'eva, T. A. Sultanyan, and I. N. Chaporova (All-Union Scientific-Research Inst. of Hard Alloys). Zavodskaya Lab. 24, 1090-2(1958). (In Russian)

Electron microscopic studies were made of the submicrostructure of tungsten powder prepared by hydrogen reduction of tungsten anhydride at 900 and 1200°C and of specimens of compacted tungsten prepared by welding preliminary sintered tungsten moldings. (R.V.J.)

**11239**

SPECTROPHOTOMETRIC AND KINETIC METHODS OF ASSAYING MOLYBDENUM IN ALLOYS. K. B. Yatsimirskii, et al. Zavodskaya Lab. 24, 1427-9(1958). (In Russian)

The ultraviolet absorption of molybdate ions (220-240 m $\mu$) at alkaline pH is used to assay Mo in steels and nickel alloys. The kinetic (catalytic) method is based on the oxidation of iodide by $H_2O_2$ at acid pH; Fe, Cu etc. are prevented from interfering with EDTA. (TCO)

**11240**

ION EXCHANGE APPLIED TO ASSAYING Mg in Zr. S. V. Elinson. Zavodskaya Lab. 24, 1434-6(1958). (In Russian)

A sulfonated cation exchanger is used with the oxalates; the Mg is held back but the Zr passes through. Hf, Al, Fe, and Ti also pass through; most of the Ca is eliminated by filtering. The Mg is recovered and precipitated with hydroxyquinoline. (TCO)

**11241**

OBRABOTKA SPLAVOV DAVLENIYEM; SBORNIK STATEY. (Pressure Treatment of Alloys; Collection of Articles.) N. I. Korneyev, I. G. Skugarev, A. I. Samokhodskii, P. B. Morozova, V. P. Rozhin, and A. S. Zaymovskaya, eds. Moscow, Oborongiz, 1958. 141p.

This book is intended for engineers, technicians, and research workers interested in the shaping and working of various metals and alloys. The collection of articles deals with modern methods of forming nickel alloys, structural steels, heat-resistant alloys, titanium alloys, and also aluminum and magnesium alloys. A description is given of the methods of measuring resistance of these metals to deformation. The results of various developments, together with some experimental work in sheet metal forming, are presented. (TCO-W.D.M.)

**11242**

GROWTH AND PERFECTION OF CRYSTALS. Proceedings of an International Conference on Crystal Growth held at Cooperstown, New York on August 27-29, 1958. R. H. Doremus, B. W. Roberts, and David Turnbull, eds. New York, John Wiley & Sons, Inc., 1958. 620p.

The papers presented at this conference were on the following subjects: growth of whiskers; properties of whiskers and crystal imperfections; growth of crystals of the solvent phase; growth of crystals of the solute phase; and crystallization of polymers. (W.L.H.)

## PARTICLE ACCELERATORS AND HIGH-VOLTAGE MACHINES

**11243** CERN-59-6

**European Organization for Nuclear Research, Geneva.**

**LES VÉRINS HYDRO-MÉCANIQUES SUPPORTANT LES AIMANTS DU SYNCHROTRON À PROTONS. (The Hydromechanical Jacks Supporting the Magnets of the**

Proton Synchrotron.) H. Horisberger. Feb. 16, 1959. 13p.

The CERN proton synchrotron magnet support arrangement which is to compensate for eventual ground movement is discussed. Each magnet unit is supported by two 10T and one 20T hydraulic jacks. The jacks, which allow precise horizontal and vertical adjustment from a remote point, are described in detail. (T.R.H.)

**11244** NP-7346

Joint Inst. for Nuclear Research, Dubna, U.S.S.R., Lab. of Nuclear Problems.

INVESTIGATION OF THE ENERGY CHARACTERISTICS OF THE 6 METER SYNCHROCYCLOTRON EXTERNAL PROTON BEAM. I. M. Vasilevskii (Vasilevsky) and Yu. D. Prokoshkin. 1958. 15p.

Measurements were made of the energy spectrum and the mean energy of the external proton beam of the Joint Institute for Nuclear Research 6-meter synchrocyclotron at various acceleration regimes. The spectrum is described by the Gaussian curve with the dispersion (2.8 ± 0.3) Mev. The mean energy was determined with an accuracy of 0.1%. (auth)

**11245**

THE DETERMINATION OF THE ISOTOPE RATIO U$^{238}$/U$^{234}$ WITH AN ALPHA SPECTROMETER. F. I. Havliček (J. Stefan Institut, Ljubljana, Yugoslavia). Nuovo cimento (10) 11, 198-211(1959) Jan. 16. (In German)

An alpha spectrometer, used in conjunction with an ionization chamber for measurement of electrons generated and designed for the determination of the isotopic ratio U$^{238}$/U$^{234}$ is described. Its accuracy for the determination of the ratio using vaporized uranium hexafluoride is shown. (tr-auth)

**11246**

ON THE MAXIMAL ENERGY AND INTENSITY OF THE ELECTRONS ACCELERATED BY THE MICROTRON. F. Porreca (Univ. of Naples). Nuovo cimento (10) 11, 283-6(1959) Jan. 16.

Keeping in account the electron's acceleration time in a microtron operating with $a = 2$ and $b = 1$ and the pulse duration of the magnetron, the maximal values of the energy and the intensity of the accelerated beam are established. (auth)

**11247**

OPERATION AT 1000 Mev OF THE FRASCATI ELECTRON SYNCHROTRON. A. Alberigi, F. Amman, and C. Bernardini, et al (Laboratori di Frascati, [Rome]); M. Ageno (Istituto Superiore di Sanita, Rome); and E. Persico (Univ. of Rome). Nuovo cimento (10) 11, 311-12(1959) Jan. 16.

The characteristics of the Frascati electron synchrotron are summarized, and its initial operation at 1000 Mev is described. (A.C.)

**11248**

ELECTROSTATIC TRANSFORMER TYPE PARTICLE ACCELERATOR USING CERAMIC BaTiO$_3$ (FERROSTAC). Toshikazu Shibata, Atsutomo Toi, and Tokuo Suita (Osaka Univ.) and Shunkichi Kisaka (Matsushita Electric Industrial Corp., Ltd., Osaka). J. Phys. Soc. Japan 14, 227(1959) Feb.

A particle accelerator which combines several advantages of the Van de Graaff and Cockcroft-Walton type accelerators is described. The essential feature of this accelerator is that the high-voltage generator has rotating ferroelectric ceramic disks or capacitors which carry electric charges. (J.H.M.)

**11249**

ENGINEERING DESIGN, 7 Gev PS. P. Bowles (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nuclear Eng. 4, 157-64(1959) Apr.

The over-all design of the proton synchrotron has been finalized while the design of some details continues. The six main components of the system from a design viewpoint are the injector, magnet, RF accelerator unit, vacuum system, power supplies, and control system. These components are discussed in some detail. (W.D.M.)

**11250**

BUILDINGS, CIVIL ENGINEERING AND SERVICES, 7 Gev PS. G. W. Dixon (Atomic Energy Research Establishment, Harwell, Berks, Eng.) and A. G. Entwistle. Nuclear Eng. 4, 164-8(1959) Apr.

The various buildings for the 7-Bev proton synchrotron and their functions are discussed. Civil engineering information for sub-soil, magnet room, injector room, shielding bridge, and tunnels is listed. Electrical services, plant cooling, handling facilities, and general services are described. (W.D.M.)

**11251**

DAMPING OF PARTICLE OSCILLATIONS IN STRONG FOCUSING ELECTRON SYNCHROTRON. Yu. F. Orlov, E. K. Tarasov, and S. A. Kheifets (Inst. of Physics, Academy of Sciences, Armenian S.S.R.). Pribory i Tekh. Ekspt. No. 1, 17-20(1959) Jan.-Feb. (In Russian)

A method of oscillation damping by means of magnetic field variations along the orbit is described. (tr-auth)

**11252**

MAGNETIC FIELD DISTORTION BY METAL VACUUM CHAMBER IN THE STRONG FOCUSING ACCELERATOR. Yu. F. Orlov and S. A. Kheifets (Inst. of Physics, Academy of Sciences, Armenian S.S.R.). Pribory i Tekh. Ekspt. No. 1, 21-3(1959) Jan.-Feb. (In Russian)

Equations are derived for describing the magnetic field inside a vacuum chamber with elliptical and rectangular cross sections. (tr-auth)

**11253**

ELECTRON-OPTICAL ELECTRODE SYSTEMS FOR ELECTRON ACCELERATOR INJECTORS. I. M. Samoilov. Pribory i Tekh. Ekspt. No. 1, 24-7(1959) Jan.-Feb. (In Russian)

Simple electrode systems with spiral and ribbon cathodes used in betatron and synchrotron injectors were investigated. The causes of poor reproducibility of the Kerst injector electron-optical parameters were found. Systems with ribbon cathodes, suggested for experimental investigation, have practically parallel electron beams which permit angular beam divergence changes up to 15 to 20°. (tr-auth)

**11254**

EFFECT OF VOLUME PRESSURE ON SELF-DIFFUSION OF IRON IN IRON ALLOYS WITH SMALL ADDITIONS OF ALUMINUM. S. D. Hertsriken and M. P. Pryanishnikov (Inst. of Metal Physics, Academy of Sciences, Ukrainian S.S.R.). Ukrain. Fiz. Zhur. 3, 651-8(1958) Sept.-Oct. (In Ukrainian)

The effect of volume pressure (effected by means of argon in a special chamber) up to 150 kg per cm$^2$ on iron diffusion parameters was investigated in iron alloys with 0.27 and 0.39% of aluminum. The temperature interval of the investigation was 1100 to 1250°C. It was shown that the pressure causes a sharp decrease in the self-diffusion activation energy and perceptibly raises the rate of self-diffusion. Up to a pressure of $p = 100$ kg per cm$^2$, linearity of $\ln D = f(P)$ is noted. (auth)

# PHYSICS AND MATHEMATICS

## General

**11255** AECU-4069
Oklahoma State Univ., Stillwater. School of Mechanical Engineering.
INTERIM REPORT ON A STUDY OF THE USE OF FURNACE CALORIMETRY FOR THE RAPID DETERMINATION OF SPECIFIC HEAT OF SOLIDS AT HIGH TEMPERATURES. J. H. Boggs and J. A. Wiebelt. Feb. 1959. 33p. Project No. 6. Contract AT(11-1)-71. $6.30(ph), $3.00(mf) OTS.

Techniques for rapid determination of heat capacity of solids were investigated. The progress in the research includes design and construction of a vacuum furnace system which will attain a 3000°F temperature, investigation of the uses of the furnace for comparative calorimetry at 1500°F, and analysis of the calorimetric method to determine what physical factors are involved. Plans for future research are discussed. (J.R.D.)

**11256** AERE-C/R-2785
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
DIFFUSION EQUATION FOR FISSION PRODUCTS IN A HOLLOW CYLINDER. N. R. Large. Jan. 1959. 14p.

The diffusion of fission products entering a hollow cylinder at its inner surface is studied. A complete solution for one set of boundary conditions is given. (J.E.D.)

**11257** AERE-ED/R-1392
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
SOME EXPERIMENTS WITH A HIGH SPEED REFRIGERATING CYCLONE. C. H. Robinson and Frank Sterry. June 3, 1954. 40p.

The results of experiments to test the feasibility of freezing out, and subsequently separating, condensible impurities from a more permanent gas, by passing the mixture through a cyclone utilizing speeds sufficiently high to cause the necessary drop in static temperature are described. The experiments were made with air containing a high proportion of water vapor, at an initial pressure of 100 psi, in a cyclone of width 1 in. and with nozzles pitched on a diameter of about 8 in. Although expansion ratios across the cyclone up to about $3\frac{1}{2}:1$ were attained and, later $\alpha$-rays were used to ionize the supersaturated air, no condensation or separation was observed, over a wide range of conditions. Application of semi-empirical theory (from meteorological sources) indicates that the time of flight in a supersaturated condition was insufficient to allow enough droplet growth (although it should have been sufficiently granted the very critical correct number of droplet nuclei); attempts to increase the time resulted in additional friction which spoiled the cooling and nullified the increase. Secondary objects were to measure over-all friction losses of cyclone and nozzle systems separately. The cyclone losses are given in straightforward form as well as (in special cases, which in fact covered most readings) reduced to a Fanning friction factor which lies considerably above "pipe" data. A better way of calculating pressure loss is referred to. Some nozzle arrangements which might, for mechanical reasons, have been useful for other projects, were shown to be relatively inefficient. (auth)

**11258** AERE-I/R-1832
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
MEASUREMENT OF THE THICKNESS OF ALUMINIUM CLADDING ON URANIUM-238 FUEL ELEMENTS. J. F. Cameron. Oct. 1956. 16p.

The thickness of the aluminum cladding on uranium fuel elements has been measured using the 2.32-Mev beta particles from the protoactinium-234 in equilibrium with the uranium-238 in the fuel element. The cladding thickness is measured with an accuracy of ±0.001 inch in one minute. An estimate can also be made by this method of the protoactinium-234 distribution in a composite fuel element. (auth)

**11259** AERE-M/M-101
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
THE AUTORADIOGRAPHIC DETERMINATION OF SELF DIFFUSION COEFFICIENTS. A. D. Le Claire. Aug. 29, 1955. 5p.

A mathematical expression is derived for the calculation of diffusion coefficients from data obtained by autoradiography. (auth)

**11260** AERE-R/R-2097
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
CALIBRATION OF SPONTANEOUS FISSION NEUTRON SOURCES. R. Richmond and B. J. Gardner. Mar. 1957. 21p. (TNCC(UK)-12).

A spontaneous fission neutron source consisting of a one-inch diameter sphere of plutonium containing $8\frac{1}{2}\%$ Pu-240 was calibrated by comparison with a number of standard neutron sources in a tank of manganous sulfate solution. The value obtained for the strength of the source was $2.032 \pm 0.030 \times 10^4$ neutrons/sec. The source was used to determine the strengths of similar sources from Chalk River and Los Alamos and also to measure the spontaneous fission neutron emission rate of natural uranium. (auth)

**11261** AERE-R/R-2782
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
THE EFFECT OF HYDROGEN CONTENT ON NEUTRON DOSE ATTENUATION IN PORTLAND CONCRETE. A. F. Avery and J. H. W. Simmons. Jan. 1959. 16p.

The build-up of thermal and intermediate energy neutrons in equilibrium with the high-energy penetrating neutron flux was studied for Portland concrete with hydrogen contents varying from 0.1 to 1.0% by weight. The asymptotic dose contributions from thermal neutrons and from intermediate energy neutrons are found to increase significantly if the hydrogen content is reduced below 0.5 and 0.3%, respectively. (auth)

**11262** AERE-T/M-174
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
A PROGRAM FOR THE CALCULATION OF FISSION PRODUCT ACCUMULATION. E. G. H. Crouch. Feb. 1959. 13p. $0.35(BIS).

The program "Poison's Calculation, Mark 2" performs the same calculation as the Mark 1 version but is written for the Mercury computer and uses a different means of specifying values of time which are spread logarithmically over the time-range. There are small differences in presentation of data and in the operating instructions. (auth)

**11263** AERE-T/R-1429
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
A METHOD FOR SOLVING THE VELOCITY-DEPENDENT BOLTZMANN EQUATION. J. P. Elliott. May 1954. 15p.

A method is derived for solving the Boltzmann equation in a system containing hydrogen, in which the spectrum contains a spread of neutrons from fast to thermal. It differs from the method for a homogeneous system of hydrogen and fissile material since such a system has no very slow neutrons. The method is applied to the calculation of critical size of a fissile sphere surrounded by hydrogenous material in which very slow neutrons accumulate. It is also applied to a different type of calculation, namely the determination of the spectrum in a system with a supply of fast neutrons but no fission. (auth)

**11264** AERE-X/R-2764
Cambridge Univ., England. Engineering Lab.
THE HYDRAULIC ANALOGY TO SIMPLE SHOCK TUBE FLOW. M. D. Cowley. Dec. 1958. 28p.

A 5 in. wide water channel was converted to produce a model for shock tube flow. Photographic sequences of the flow, clearly silhouetted, are presented, showing the waves initiated by the breaking of the shock tube diaphragm. Some wave interactions and quantitative results for traveling hydraulic shocks or jumps are included. (auth)

**11265** AFOSR-TN-58-791
Plasmadyne Corp., Santa Ana, Calif.
FUNDAMENTAL INVESTIGATION OF ELECTRICAL POWER SOURCES FOR ELECTRIC THRUST DEVICES—BIBLIOGRAPHY. Technical Note No. E-2TN098-332. Helen Fife. Sept. 3, 1958. 47p. Contract AF49(638)-332. (AD-202224).

The bibliography consists of 380 references. Possible power sources are arranged according to whether they are (a) internal (wholly contained with in the space vehicle), (b) waste (utilize waste products from other functions) or direct storage, and (c) certain detailed categories. (A.C.)

**11266** APAE-Memo-183
Alco Products, Inc., Schenectady, N. Y.
ATBAC CHECK CALCULATION ON THE IBM 650, PROGRAM NO. 303. I. Beretsky and P. V. Oby. Mar. 13, 1959. 14p. Contract AT(30-3)-326. $3.30 (ph), $2.40(mf) OTS.

This program, using the IBM 650 electronic data processing machine, is used primarily as a tool in order to prepare input data for an IBM 704 code ATBAC. The code calculates steady state thermal characteristics of a plate type fuel element for both a nominal and adverse channel. (auth)

**11267** APL/JHU-TG-326
Johns Hopkins Univ., Silver Spring, Md. Applied Physics Lab.
BIBLIOGRAPHY ON THERMOELECTRICITY. S. Goldman. Nov. 1958. 24p. Contract NOrd-7386.

The bibliography on thermoelectricity lists the literature cited in Physics Abstracts, Electrical Engineering Abstracts, and Chemical Abstracts from January 1939 through 1958. 140 references. (J.E.D.)

**11268** BLG-32
Brussels. Centre d'Étude de l'Énergie Nucléaire.
RADIOISOTOPES PRODUITS EN BELGIQUE PENDANT L'ANNEE 1958. (Radioisotopes Produced in Belgium During the Year 1958.) R. Constant and J. Mekers. Jan. 14, 1959. 8p.

The situation with regard to production of radioisotopes in Belgium during 1958 (first year of production) is given. Besides a detailed table with the number of shipments and the delivered activity per isotope, several recapitulatory tables are given which permit evaluation of the evolution of the situation during the year for some important isotopes, as well as for production in general. (auth)

**11269** BNL-2490
Brookhaven National Lab., Upton, N. Y.
MULTIPLE INTERACTIONS OF NEUTRONS IN RESONANT SLABS. James E. Draper. Sept. 19, 1955. 33p. $6.30(ph), $3.00(mf) OTS.

The multiple interactions of neutrons in slabs is considered with emphasis on the case of resonant scatter and capture. The important change of cross section due to neutron energy loss on scattering is included as are the effects of Doppler broadening of resonances and potential scattering followed by a resonant interaction. Calculations are made with and without a resonant self-absorber interposed before the slab. The probabilities are integrated over the resonance. Curves are presented which permit calculation of the ratio of multiple interactions to first interactions. (auth)

**11270** BRL-1060
Ballistic Research Labs., Aberdeen Proving Ground, Md.
LAWS FOR LARGE ELASTIC RESPONSE AND PERMANENT DEFORMATION OF MODEL STRUCTURES SUBJECTED TO BLAST LOADING. W. E. Baker, W. O. Ewing, Jr., and J. W. Hanna. Dec. 1958. 55p. Sponsored by AEC under DA Project No. 5B03-04-002. $1.75(OTS).

A model law is developed for scaling of response-to-blast loading of structures which undergo large elastic and plastic deformations. In the derivation of the model law, strain-rate and gravity effects are assumed negligible. The geometrical scaling of response predicted by the law is verified by a series of experiments on small cantilever beams. (auth)

**11271** CF-58-2-14
Oak Ridge National Lab., Tenn.
A SPHERICAL SHELL LOADED ALONG A LATITUDE CIRCLE. B. L. Greenstreet. Feb. 10, 1958. 19p. Contract [W-7405-eng-26]. $3.30(ph), $2.40(mf) OTS.

A stress analysis is presented of a spherical shell subjected to a line load acting along a latitude circle in a direction normal to the plane of that circle. (auth)

**11272** CF-58-4-77
Oak Ridge National Lab., Tenn.
STUDY OF GAMMA RAYS PRODUCED BY NEUTRON INTERACTIONS IN AIR. V. R. Cain, F. J. Muckenthaler, and C. E. Clifford. May 29, 1958. 26p. Contract W-7405-eng-26. $4.80(ph), $2.70(mf) OTS.

An experiment was performed at the Tower Shielding Facility to study the production of secondary gamma rays in air by thermal-neutron capture in nitrogen and by the inelastic scattering of fast neutrons. A beam of neutrons from the TSF reactor irradiated a cone of air, and the gamma rays resulting from neutron interactions within the cone were observed by a gamma-ray spectrometer several feet away. The ratio of the nitrogen capture gamma rays observed to the other gamma rays observed was varied by covering the reactor neutron beam with boron-impregnated plexiglas for some of the measurements. The difference between the measurements was then used to separate the pulse-height spectrum associated with nitrogen capture gamma rays from the spectrum associated with other sources. In this investigation, the spectrum which remained after the subtraction of the capture gamma-ray spectrum was presumed to be due to inelastically scattered fast neutrons; however, contributions from other sources must be considered. The results of the experiment are to be compared with theoretical calculations of the pulse-height spectra to be expected from various sources. (auth)

**11273** CU-170
Columbia Univ., New York. Pupin Cyclotron Lab. and Columbia Univ., New York. George B. Pegram Lab.
THE DETAILS OF THE EQUIPMENT AND THE EXPERIMENTAL PROCEDURE USED FOR SCATTERING EXPERIMENTS PERFORMED AT THE BROOKHAVEN NATIONAL LABORATORY 60-INCH CYCLOTRON. Vera K. Fischer. Mar. 2, 1959. 29p. Contract AT-30-1-GEN-72. $4.80(ph), $2.70(mf) OTS.

The design and construction of a scattering chamber intended primarily for use with gas targets is discussed, together with special alignment devices and techniques and the beam collection and integration system. The gas handling system, the gas cells, and three types of counters are described, and short discussions of beam energy determinations, counter geometry, and sources of error are also included. (auth)

**11274** IDO-12005
Weather Bureau, Idaho Falls, Idaho.
WORKBOOK IN ATMOSPHERIC DIFFUSION CALCULATIONS. G. A. De Marrais. Feb. 1959. 66p. $1.75 (OTS).

The equations and nomographs most frequently used in calculating behavior of stack effluents are given and explained. (T.R.H.)

**11275** IGR-TN/CA-875
United Kingdom Atomic Energy Authority. Industrial Group. Capenhurst Works, Capenhurst, Ches., England.
THE THERMAL CONDUCTIVITY OF SOLID BORON TRIFLUORIDE. E. J. Burton, P. J. Stokes, and A. B. Murphy. 1958. 12p.

The thermal conductivity of solid boron trifluoride was measured approximately by comparison with frozen benzene, using a radial heat flow type of conductivity cell. Over the temperature range 85 to 130°K an average value of $1{\cdot}0 \times 10^{-3}$ cal cm$^{-1}$ s$^{-1}$ deg$^{-1}$C was obtained, but values ranged from $0{\cdot}6$ to $1{\cdot}3 \times 10^{-3}$ cal cm$^{-1}$ s$^{-1}$ deg$^{-1}$C, depending on the way the material solidified. (auth)

**11276** ITR-1499
Sandia Corp., Albuquerque, N. Mex. and California. Univ., Livermore. Radiation Lab.
PRELIMINARY SUMMARY REPORT OF STRONG-MOTION MEASUREMENTS FROM A CONFINED UNDERGROUND NUCLEAR DETONATION. William R. Perret and Roger G. Preston. June 15, 1958. 34p. Program 26 [of] OPERATION PLUMBBOB. $6.30(ph), $3.00(mf) OTS.

The background, techniques employed, and results of the strong-motion measurements from the first test by the United States of a confined, underground, nuclear detonation are summarized.

**11277** ITR-1528
Stanford Research Inst., Menlo Park, Calif.
SURFACE MOTION FROM AN UNDERGROUND DETONATION. Preliminary Report. L. M. Swift, D. C. Sachs, J. L. Brenner, and W. M. Wells. Oct. 15, 1957. Decl. July 3, 1958. 61p. Project 26.4a [of] OPERATION PLUMBBOB. $10.80(ph), $3.90(mf) OTS.

Surface and near-surface acceleration and strain were measured on a deep underground nuclear burst (Rainier Shot; 900 ft; 1.7 kt) to permit extrapolation of results to nuclear detonations of other yields under different test or employment conditions. Results indicate that a large earth cap, beginning approximately 180 ft below the mesa surface, separated from the mesa over the charge and subsequently fell back into place. The only significant vertical displacement occurred at or near ground zero and reached a maximum of 1 ft. Both acceleration and horizontal strain measurements suggest that the principal disturbance on the mesa surface was confined to a small region around ground zero. From preshot seismic survey data and Rainier gage arrival times and average vertical strains it is concluded that the medium was many-layered with seismic velocities which were widely different in the various layers. These conclusions resulted from a preliminary analysis of the data. (auth)

**11278** ITR-1529
Sandia Corp., Albuquerque, N. Mex.
SUBSURFACE MOTION FROM A CONFINED UNDERGROUND DETONATION. PART I. Interim Report. William R. Perret. Oct. 1957. 64p. Project 26.4b [of] OPERATION PLUMBBOB. $9.30(ph), $3.60(mf) OTS.

Strong motion observations within the mesa adjacent to Rainier shot of Operation Plumbbob (1.7 kt) were made on a horizontal radius (along the access tunnel) and a vertical radius by Sandia Corporation under Project 26.4b. Principal data were derived from radial component acceleration measurements. Long-base strain gages provided some secondary data. Horizontal radius data were derived from gages at distances ranging from 100 to 1,355 feet from the burst point. Vertical radius data were obtained over distances ranging from 366 to 896 feet at the mesa top surface. Many of the accelerometers used in Project 26.4b were given set ranges so far below actual peak accelerations that recorder system overloading caused saturation and serious loss of precision in record peak amplitudes. All arrival time data are good, but amplitude data are questionable in many cases. Accelerometers at closer stations on both radii were not seriously overranged and data from them are reliable. Corrections based on a few records from Project 26.4a gages of a vertical radius installation were made for the overranged Project 26.4b gages of the vertical radius. Corrected and uncorrected acceleration-time data for the vertical radius gages were converted to particle velocity and displacement information by integration. Horizontal radius data show peak accelerations decreasing approximately as the inverse fourth power of radial range between about 3,500 g at 100 feet and 10 g at, roughly, 400 feet where the rate of decrease approaches the inverse square of range. Peak accelerations from the vertical radius decrease with range up to the vicinity of transition from weak bedded tuff to the welded tuff (rhyolite) cap rock. From this region upward toward the surface record, character changes radically. A sharp upward acceleration pulse is followed by a relatively long period of free fall at about −1 g (true zero g for the accelerometer biased to +1 g in calibration). A sharp upward rebound pulse and a decaying oscillatory train complete the motion. Free fall originates at all gages nearly simultaneously but ends at progressively later times upward. Rebound initiation sequence suggests that horizontal parting or spalling occurred at three levels from beneath the cap rock upward to the surface. Initial peak accelerations through the cap rock region increase with increasing radial range. This cannot be attributed to surface reflection except at the surface gage. The anomalous increase in amplitude may be caused by continuously decreasing seismic impedance ($\rho c$) upward through the cap rock, with consequent continuous reflection of the compression wave with enhanced peaks. Horizontal strain gages on the tunnel walls survived for periods too short to observe significant motion. Strain gages on the vertical radius showed significant, but small, compressive strains; however, they may have been constrained from free tensile motions by mounting cables. (auth)

**11279** KAPL-M-IB-10
Knolls Atomic Power Lab., Schenectady, N. Y.
USE OF RARE EARTHS AS NEUTRON ABSORBERS.
I. Bornstein. Jan. 7, 1953. Decl. Feb. 10, 1959. 17p.
Contract W-31-109-Eng-52. $4.80(ph), $2.70(mf) OTS.

The usefulness of $B_4C$ as a neutron absorbing material is limited by the generation of helium by the $(n,\alpha)$ reaction with boron. Many of the rare earths exhibit the highest neutron absorption cross sections in the ev range, and none of them undergoes a $(n,\alpha)$ reaction. The attractiveness of a material with a high neutron absorption cross section in the ev range but without a $(n,\alpha)$ reaction prompted an investigation of the feasibility of using a rare earth mixture as a neutron absorber control material in SIR. Some studies made of a commercially available mixture of rare earth oxides $(Gd, Sm)_2O_3$ are summarized, and investigations are recommended on the use of $Sm_2O_3$ and an "optimum" mixture as neutron absorbers for SIR. (auth)

**11280** KAPL-M-RJM-3
Knolls Atomic Power Lab., Schenectady, N. Y.
A SIMPLIFIED METHOD OF CALCULATING BETA DOSE RATES. Robert J. Mazairz. Mar. 1, 1959.
24p. Contract W-31-109-Eng-52. $4.80(ph), $2.70(mf) OTS.

The total dose rate in air from an exposed radioactive source, such as surface contamination on reactor power plant components, must necessarily include the contributions from beta and low energy ($E < 0.5$ Mev) gamma rays as well as the contribution from the high energy gamma rays. An analysis of this type of problem is presented with emphasis placed on a method for calculating the dose rates from beta rays and low energy gamma rays. It was found that the ratio of beta to gamma ray surface dose rates varies from a low of 7.3 for $Mn^{54}$ to a high of 8800 for $Y^{90}$. (auth)

**11281** NARF-59-9T
Convair, Fort Worth, Tex.
AN EXPERIMENT TO TEST THE EXTENSION OF THE MOMENTS METHOD OF CALCULATION OF FINITE MEDIA. D. D. Babb and R. E. DeWames. Mar. 13, 1959. 56p. Project 6(1-9964). Contract AF33(600)-32054. (MR-N-228).

An experiment was performed at Convair-Fort Worth to determine the applicability of radiation penetration data calculated by the moments method (which assumes a single, infinite medium) to problems involving more than one medium. In the experiment, fast-neutron and gamma dose rates and thermal-neutron fluxes were measured in the vicinity of an air-water interface, as functions of the distance from the detector to the water surface, with the source-detector separation and the height of the source-detector axis relative to the water surface as parameters. The use of artificial sources, detectors of small sensitive volume, and minimum framework resulted in the geometry approaching that of a point source and detector. Under the assumption of an infinite water medium, dose rates were calculated from moments-method data for comparison with the experimental values. The calculations involved dividing the line segment between the source and detector into a part in water and a part in air (considered a void) and determining the attenuation by the water. For a $Co^{60}$ gamma source, the use of moments-method data was found to be completely valid for degraded energies greater than 0.52 Mev. Validity below 0.52 Mev was not explored because of the limited response of the detectors. For the most realistic geometry, namely source in water and detectors in air, the presence of a boundary caused a 7% decrease in the measured fast-neutron dose rate. (auth)

**11282** NARF-59-10T
Convair, Fort Worth, Tex.
SPECTRAL AND ANGULAR DISTRIBUTIONS OF AIR SCATTERED $Co^{60}$ GAMMA RAYS. Supplement No. 1.
B. S. Burton, Jr. Mar. 5, 1959. 14p. Project No. 6 (1-9964). Contract AF33(600)-32054. (MR-N-168-1).

The data presented in MR-N-168 are not complete; the spectra for a number of angles were omitted. The scale of reproduction for the curves in MR-N-168 is such that quantitative interpretation of the data is difficult. Plots of all experimental data are presented. There are three sets of spectra: separation distance of 40 ft, 10° collimator, separation distance of 40 ft, 6° collimator, and separation distance of 89 ft, 10° collimator. The abcissa on the graphs is channel number; the ordinate is in counts per minute per channel. Two calibration energies are indicated at the bottom of each graph; the corresponding energy per channel is given in the legend on each page. Energy calibration is accurate to better than ± 3%. It is noted that zero energy generally does not quite correspond to the zero-th channel. (auth)

**11283** NDA-15C-83
Nuclear Development Corp. of America, White Plains, N. Y.
GUIDE TO SEAC PRINTED OUTPUT TAPES OF GAMMA RAY PENETRATION CALCULATIONS.
S. Preiser, C. Jensen, and H. Goldstein. Oct. 20, 1955.

16p. Contract AT(30-1)-862. $3.30(ph), $2.40(mf) OTS.

Usable tapes from the output of NBS Standards Eastern Automatic Computer (SEAC) on gamma-ray penetration calculations were microfilmed. A guide to the tapes is presented. Included is a description of the information listed on each tape, a serial catalog of all the output tapes of which microfilm copies have been made, and a listing of errata. (J.R.D.)

**11284** NP-7341

Joint Inst. for Nuclear Research, Moscow. Lab. of Theoretical Physics.

DETERMINATION OF CAPTURE REGION FOR EQUATION OF THE SECOND ORDER CLOSE TO A CONSERVATION ONE. V. K. Mel'nikov. 1958. 25p.

The solution is given of a differential equation for describing particle acceleration in an accelerator. The capture region is determined for the equation $(d/dt)(m(\epsilon,t)\dot{x}) + K(\epsilon,t)p'(x) = \epsilon f(\epsilon,t,x,\dot{x})\dot{x}$, where $\epsilon$ is a small parameter which may be considered nonnegative and the functions $m(\epsilon,t)$ and $K(\epsilon,t)$ for $\epsilon = 0$ are independent of t. The problems of finding the capture regions arise in calculations for charged particle accelerators of different types. The particles accelerated in any resonance accelerator undergo so-called "phase oscillations" described by a certain nonlinear equation, and the capture region of this equation determines the number of particles captured in the acceleration regime. From a mathematical point of view a certain analog of the separatrisses is introduced which makes it possible to separate the motions of different types. The method for the practical determination of these separatrisses is given. (A.C.)

**11285** NP-7351

Carnegie Inst. of Tech., Pittsburgh. Metals Research Lab.

THEORY OF $D_0$ FOR RING SELF-DIFFUSION IN METALS. G. M. Pound, W. R. Bitler, and H. W. Paxton. [1958]. 18p. Contract Nonr-760(08).

The kinetics of ring self-diffusion in metals is treated in terms of statistical mechanics from the viewpoint of absolute rate theory. It is concluded that there are contributions to the entropy and enthalpy of activation which may be evaluated by considering the vibratory synchronization of the n ring atoms in the directions for rotation. These negative contributions are called the synchronal thermodynamic quantities of activation. At experimental temperatures the synchronal entropy is given by $\Delta S_a = (1-n)k \ln(6ef_v)$, and it should be of the order of $-20$ e.u. for 4-atom ring self-diffusion, resulting in a negative experimental entropy of activation. Thus it is suggested that a low $D_0$, perhaps of the order of $10^{-4}$cm$^2$-sec$^{-1}$, is an experimental criterion for 4-atom ring diffusion. The present theory indicates that the self-diffusion in pure chromium occurs principally by the 4-atom ring mechanism. Further, it is concluded that there are synchronal contributions to the entropy and enthalpy of activation of all processes in solids which require a simultaneous, cooperative, and similar movement of n atoms. (auth)

**11286** NP-7370

California. Univ., Los Angeles.

ULTRASONIC ATTENUATION IN METALS AT LOW TEMPERATURES. Technical Report No. XIII. Daniel H. Filson. Jan. 1959. 70p. Project NR014-302. Contract Nonr-233(48).

The attenuation of ultrasonic waves due to the electron-lattice interaction is examined. The investigation was concerned principally with the loss in the normal state and compares the experimentally determined loss with the existing theories for the effect. The frequency range of 100 to 1000 kc was used in the investigation. (W.D.M.)

**11287** NYO-8677

New York Univ., New York. Atomic Energy Commission Computing and Applied Mathematics Center.

MAGNETO-HYDRODYNAMIC SHOCK STRUCTURE USING FRICTION. Cathleen S. Morawetz. Jan. 12, 1959. 24p. Contract AT(30-1)-1480. $4.80(ph), $2.70(mf) OTS.

From the equations of motion for two charged fluids with scalar pressures it is shown that there exists a steady shock profile if there is friction between the two fluids proportional to the difference between their velocities. (auth)

**11288** NYO-8705

Westinghouse Electric Corp. Research Labs., Pittsburgh.

ULTRAHIGH VACUUM TECHNIQUES. Quarterly Progress Report [for] November 1, 1958—January 31, 1959. Research Report 403FF312-R5. Feb. 27, 1959. 12p. Contract AT(30-1)-2176. $3.30(ph), $2.40(mf) OTS.

The interesting results obtained with Teflon as an ultrahigh vacuum material have been further investigated with very satisfactory results. As a consequence of these investigations, plans are being initiated to build an ultrahigh vacuum valve with an open conductance in excess of 1000 liters/sec. In addition, a major development has been made in the area of large conductance, non-refrigerated isolation traps by introducing a suitable ultrahigh vacuum material which traps backstreaming pump products with extremely high efficiency. To date, traps with conductances of 300 liters/sec have isolated ultrahigh vacuum systems for more than a month. Satisfactory progress has been made in the more basic areas of research such as: ionic induced reemission of gases from surfaces, the chemical pumping of active gases, and the factors limiting the attainment of ultrahigh vacua. (For preceding period see NYO-8702.) (auth)

**11289** SC-4239(TR)

Sandia Corp., Albuquerque, N. Mex.

BLAST LOADING OF STRUCTURES IN THE REGULAR REFLECTION AND LOW MACH-STEM REGIONS. J. P. Murtha. Feb. 1959. 90p. Contract [AT(29-1)-789]. $13.80(ph), $4.80(mf) OTS.

An investigation was made of the blast loading on model structures in the regular reflection region and in the region where the height of the Mach stem varies from less than the structure height to several times the structure height. The three structure models employed were 2 × 2 feet in cross section, with lengths of 2, 4, and 18 feet. They were subjected to blast waves from 250-pound charges of TNT detonated at heights of 38, 64, and 90 feet above the surface. When scaled to nuclear burst, these conditions represent a 7-story building subjected to a 20-kt burst. They therefore constitute a situation involving multistory structures. Variations from two-dimensional theory for predicting the pressure loading on the front surface were observed for small zenith angles while variation on the top surface was observed at large zenith angles. Shortening of the positive-pressure duration on the front surface was found to occur in the regular reflection and low Mach-stem regions. The measured times of occurrence for maximum average pressure on the rear face of the 2- × 2- × 18-foot target are in good agreement with times predicted. (auth)

**11290** SCTM-32-59(51)
Sandia Corp., Albuquerque, N. Mex.
BODY AND FIN LOADS ON A HIGH-FINENESS-RATIO BODY AND BODY-FIN COMBINATION THROUGH THE MACH RANGE FROM 0.3 TO 1.2 AT ANGLES OF ATTACK UP THROUGH 40 DEGREES. Roger E. Tate. Feb. 25, 1959. 309p. Contract AT(29-1)-789. $48.60 (ph), $11.10(mf) OTS.

A test on a high-fineness-ratio pressure model was conducted in a transonic wind tunnel. Model configurations of body alone, body and fin, and body and fin with external protuberances were tested to obtain pressures from orifices positioned along the body and on the horizontal fins. Individual orifice pressures were then reduced to load distributions, normal forces, and fin centers of pressure. These are presented, in coefficient form, as graphs. The Mach range from 0.3 to 1.2 was examined in this test; however, not all configurations were tested at the same Mach numbers within the range. Angles of attack from 0 to 40° were run on most body-fin configurations. The body-alone runs were limited to somewhat lower angles of attack by excessive model oscillation in the tunnel. Test Reynolds numbers varied from $0.68 \times 10^6$ to $2.07 \times 10^6$ per foot. Test dynamic pressures were at 45 to 452 psf. (auth)

**11291** SCTM-54-59(51)
Sandia Corp., Albuquerque, N. Mex.
EXTENSION OF A DEFINITION OF CONSTANCY TO NONCIRCULAR NORMAL DISTRIBUTIONS. C. E. Abraham and W. H. Bradford. Mar. 13, 1959. 56p. Contract [AT(29-1)-789]. $9.30(ph), $3.60(mf) OTS.

British meteorologists have extensively used a measure of wind constancy based on the assumption of circular normal distribution of wind velocities. This memorandum extends the definition to include the noncircular case and exhibits results computed on the IBM 704 Electronic Data-Processing Machine in the form of graphs, tables, and nomograms. The accuracy of the computations is discussed, and examples are included which show how to interpret the nomograms. It is also suggested that the constancy number associated with a noncircular normal distribution of vectors may be useful as a measure of the expected straightness of broken-line paths generated by choosing vectors of the distribution at random and laying them end to end. (auth)

**11292** SCTM-66-59(51)
Sandia Corp., Albuquerque, N. Mex.
A RECOMMENDED UPPER ATMOSPHERE MODEL (16-400 KILOMETERS). J. W. Reed. [Apr. 2, 1959]. 12p. Contract [AT(29-1)-789]. $3.30(ph), $2.40(mf) OTS.

Information on upper air temperatures, pressures, and densities from satellite orbits and blast wave propagation has been used to define an improved model for upper atmosphere conditions. Recommended values for density are higher than the ARDC Model Atmosphere by factors of about two at 70 km, five at 150 km, and seven at 300 km. (auth)

**11293** UCRL-5414
California. Univ., Livermore. Lawrence Radiation Lab.
HIGH FLUX BOILING HEAT TRANSFER FROM A FLAT PLATE. Clyde E. Taylor and James F. Steinhaus. Nov. 25, 1958. 47p. Contract W-7405-eng-48. $1.50 (OTS).

Flat copper plates, $\frac{1}{8}$ in. thick, were heated on one side by electron bombardment of a 1-$\frac{1}{2}$ in. diameter area and cooled on the opposite side by water flowing in a 0.050 to 0.090-in.-wide passage. Data were obtained on plate temperature vs. heat flux, "burnout" heat flux vs. water velocity and the effects of various surface finishes. High-speed photographs were taken of the boiling phenomena. Audible sounds were observed and sound frequencies measured. Water velocity ranged from 2 to 41 ft/sec, water pressure from 36 to 120 psia, and heat flux to 31 kw/in.$^2$ ($15.2 \times 10^6$ Btu/hr-ft$^2$). (auth)

**11294** USNRDL-TR-303
Naval Radiological Defense Lab., San Francisco.
RESPONSE OF A LOW-GEOMETRY SCINTILLATION COUNTER TO FISSION AND OTHER PRODUCTS. P. D. LaRiviere. Feb. 4, 1959. 21p.

The theoretical response of a low-geometry scintillation counter to any photon-emitting nuclide whose decay scheme is known is developed. It is used to compute the counting rate, as a function of time, of individual and total fission products resulting from $10^4$ simultaneous slow-neutron fissions of $U^{235}$ and several other nuclides for $10^4$ initial atoms. The calculations extend from $\sim 45$ min to 301 days after fission. (auth)

**11295** WADC-TR-58-383
TRG, Inc., New York.
TRANSMISSION MATRIX AND MONTE CARLO GAMMA RAY PENETRATION. Final Report. Raphael Aronson. Apr. 1958. 45p. Project No. 7-(1-7112). Contract AF33(616)-3616. (AD-209063).

Two Monte Carlo gamma ray penetration codes, one for plane and one for spherical geometries, are presented. Important histories and how to estimate their importance, according to position within the shield, are described qualitatively. Test results for the Monte Carlo buildup factors are listed. A transmission matrix method of computing transmission through infinite plane parallel shields, made up of several layers, is presented. The matrix for a multilayer shield is the product of the matrices for the component layers. Variational principles for the multiple scattering theory of penetration through slabs are discussed. A procedure, which is adequate in a great many circumstances, to compute crudely the dose from gamma rays produced by inelastic neutron scattering in the shield is described. (auth)

**11296** WT-1532
Edgerton, Germeshausen and Grier, Inc., Boston.
PHOTOGRAPHIC ANALYSIS OF EARTH MOTION, SHOT RAINIER. July 7, 1958. 15p. Project 26.4f [of] OPERATION PLUMBBOB. $3.30(ph), $2.40(mf) OTS.

The photographic recording of earth motions resulting from the underground detonation of the Rainier device is reported. A reference light on a tower near Surface Zero was observed to rise nine inches at 390 msec after zero. This result is in agreement with results obtained by other projects. (auth)

**11297** ZPH-024
Convair, San Diego, Calif.
MAGNETIC DRAG ON SMALL SATELLITES. S. Rand. Nov. 4, 1958. 15p. Contract Nonr-2683(00).

The linearized treatment of the electro-hydrodynamic drag on a small object traversing a low density plasma supersonically is extended to include the effect of externally applied magnetic fields. (auth)

**11298** ZPH-026
Convair, San Diego, Calif.
APPLICATION OF BOHM-PINES THEORY TO PLASMA MOTION. R. Pappert. Dec. 1, 1958. 23p. Contract Nonr-2683(00).

Bohm-Pines formalism is applied to a two-component plasma. It is shown that the random phase approximation coupled with a macroscopic interpretation of the kinetic energy term is equivalent to the fluid dynamics results for an isothermal expansion. The modes of excitation of the two-component system are discussed. When the velocity of the exciting particle falls between the thermal velocity of ions and thermal velocity of electrons, a sound-type excitation occurs. This gives rise to the Kraus-Watson wake. When the velocity of the exciting particle exceeds both the thermal velocity of ions and electrons two modes of excitation appear; namely plasma oscillations of electrons and sound excitation. (auth)

**11299** AEC-tr-3607
CONCERNING THE USE OF RADIOACTIVE ISOTOPES IN METEOROLOGY AND HYDROLOGY. E. (Ye.) P. Gersht. Translated from Meteorol. i Gidrol. No. 8, 62-4(1957). 7p. $1.80(ph), $1.80(mf) JCL or LC.

A brief review and discussion of tracer techniques in meteorology and hydrology are presented. (T.R.H.)

**11300** AEC-tr-3619
PLASMA INVESTIGATIONS WITH A SMALL DIAMETER ELECTRON IRRADIATION DETECTOR. M. von Ardenne, S. Schiller, and H. Westmeyer. Translated for Oak Ridge National Lab. from Exptl. Tech. Physik 6, 49-62(1958). 26p. $4.80(ph), $2.70(mf) JCL or LC.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 14064.

**11301** AEC-tr-3627
ON PROPAGATION OF ELECTROMAGNETIC WAVES IN A PLASMA LOCATED IN A MAGNETIC FIELD, THE THERMAL MOTION OF ELECTRONS BEING TAKEN INTO ACCOUNT. B. N. Gershman. Translated for Princeton Univ. from Zhur. Eksptl'. i Teoret. Fiz. 24, 659-72(1953). 20p. $3.30(ph), $2.40(mf) JCL or LC.

The propagation of different types of electromagnetic waves in a homogeneous plasma located in a constant magnetic field is considered taking into account the thermal motion of electrons. Attention is given to the analysis of the behavior of a plasma wave. (auth)

**11302** AEC-tr-3637
NEGATIVE IONS. N. S. Buchel'nikova. Translated by A. L. Monks (Oak Ridge National Lab.) from Uspekhi Fiz. Nauk 65, 351-85(1958). 58p. (Includes original, 18p.) $9.30(ph), $3.60(mf) JCL or LC.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 287.

**11303** AEC-tr-3641
THE IMPROVEMENT OF HEAT TRANSFER TO WATER DERIVABLE FROM THE ARTIFICIAL ROUGHENING OF SURFACES IN REACTORS OR IN HEAT EXCHANGERS. Günther Grass. Translated by G. Dessauer (Savannah River Lab.) from Atomkernenergie 3, 328-31(1958). 9p. $1.80(ph), $1.80(mf) JCL or LC.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 17097.

**11304** CEA-tr-R-297
ETUDES DES PROCESSUS DE CAPTURE DE DEUX ÉLECTRONS DANS LES COLLISIONS ENTRE LES IONS POSITIFS DE CARBONE ET D'HYDROGENE ET LES MOLECULES DE GAZ. (Studies of the Processes of Capture of Two Electrons in the Collisions Between the Positive Ions of Carbon and Hydrogen and Molecules of Gas.) Ya. (Ia.) M. Fogel, R. V. Mitin, and A. G. Koval. Translated into French from Zhur. Eksptl'. i Teoret. Fiz. 31, 397-404(1956). 18p.

A double mass-spectrometer installation was used to study two-electron capture by unipositive carbon and oxygen ions in collisions with atoms of He, Ne, Ar, Kr, and Xe and molecules of $H_2$, $N_2$, and $O_2$. The cross sections for $C_1^+$ and $O_1^+$ with energies of 10.7 and 54.5 kev were measured. (T.R.H.)

**11305** CEA-tr-R-591
INTERACTION DES NEUTRONS LENTS AVEC LES NOYAUX. (The Interaction of Slow Neutrons with Nuclei.) V. V. Vladimirskii (Vladimirsky), A. A. Panov, I. A. Radkevich (Radkevitch), and V. V. Sokolovskii (Sokolovsky). Translated into French by B. Vinogradoff from Atomnaya Energ. 3, 444-58(1957). 45p.

A review is presented on experimental equipment for studying, and the results of studies on, slow neutron interactions with nuclei. (About 150 references.) (T.R.H.)

**11306** CEA-tr-R-600
ACTIVITÉ TOTALE DES PRODUITS DE FISSION DE L'URANIUM 235. (Total Activity of the Fission Products of Uranium-235.) V. N. Sakharov (B. H. Sakharov) and A. I. Malofeyev (Malofeev). Translated into French from Atomnaya Energ. 3, 334-5(1957). 6p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 9545.

**11307** IGRL-T/CA-79
THE DIFFUSION PROCESS FOR THE ENRICHMENT OF THE LIGHT ISOTOPE OF URANIUM. E. W. Becker. Translated by B. Rigby (U.K.A.E.A., Capenhurst) from Chem.-Ing.-Tech. 29, 363-71(1957). 17p.

The principles of the diffusion process for the enrichment of $U^{235}$ and the methods of achieving favorable operating conditions are shown with reference to the optimal theory of the separation process developed by Cohen, Benedict, Dirac, and others. It is shown that the output of the American diffusion plants, although not known officially, can be estimated from their power consumption. For a depletion of a waste material to one-fifth of natural concentration this gives an output of about 25 tons $U^{235}$ per year as 20% material and a consumption of about 4400 tons/year of natural uranium. The economics of the separation process is characterized by a "specific power consumption" $\zeta = 9000$ kwh/kg U and a "specific investment" $\xi = 560$/kg U per year. The official American price of $U^{235}$ corresponds basically to the total cost of power and materials. (auth)

**11308**
THE SPECIFIC HEAT OF RUBIDIUM BETWEEN 1.2 AND 4.2°K. F. D. Manchester (Univ. of Alberta, Edmonton, Can.). Can. J. Phys. 37, 525-8(1959) Apr.

Data on the specific heat of rubidium in the temperature range 1.2 to 4.2°K is presented. Measurements were made to examine the form of the temperature dependence of specific heat in this temperature range and to provide an estimate of $\theta_0$, which would serve until measurements are made below 1°K to determine

$\theta_0$ with more certainty. The results of the measurements are graphically shown. (A.C.)

**11309**

EXTREMELY LOW TEMPERATURES. PRODUCTION AND COMMERCIAL USES. O. Arnold Hansen (Union Carbide Corp., Tonawanda, N. Y.). Chem. Eng. 66, No. 4, 123-38(1959) Feb. 23.

A comprehensive discussion of extremely low temperatures is presented. In the examination of low-temperature production, the operation of the general classes of refrigeration machinery such as change of phase, Joule-Thompson effect, and expansion engine are described, as well as materials of construction and low-temperature measuring instruments. Low temperatures are applied to separating atmospheric gases, liquefying gas products such as methane, helium separation, and removal of various impurities from gases. In addition, low temperatures are used to slow down biological processes, as well as enhance the dimensional stability of castings. The theory of cryogenic insulation is discussed, and materials of construction are described. Safety precautions in dealing with low temperatures are considered, and finally a discussion of future developments is presented. (J.R.D.)

**11310**

THE ACCELERATION OF A SHOCK WAVE GENERATING THE DETONATION OF A CONDENSED EXPLOSIVE. Jacques Favier and Claude Fauquignon. Compt. rend. 248, 1291-4(1959) Mar. 2. (In French)

When a shock wave causes the detonation of a condensed explosive, there is an acceleration of this shock wave in the zone preceding the originating section of the detonation. This result permits the confirmation of a thermal scheme for the formation and support of a detonation wave in a condensed explosive. (tr-auth)

**11311**

A METHOD OF DETECTION OF NON-IONIZING SHOCK WAVES AND THE USE OF RADIOELECTRIC WAVES FOR THEIR STUDY. Roger der Agobian. Compt. rend. 248, 1308-11(1959) Mar. 2. (In French)

The detection of non-ionizing shock waves is made more sensitive by creating on their path an autonomous auxiliary plasma. The modifications produced in a thin cross section of the plasma by passage of the shock wave are studied by radioelectric exploration and optical observation. (tr-auth)

**11312**

A THEORY OF THE SUCCESSIVE PRODUCTION OF MOVING STRIATIONS IN THE PLASMA OF INERT GASES. Luděk Pekárek (Inst. of Physics, Czechoslovak Academy of Sciences, Prague). Czechoslov. J. Phys. 7, 533-56(1957).

A theory is elaborated on the successive production of moving striations (waves of stratification) in an inert gas. The stratification of the plasma is interpreted as the successive production of regions with an alternately positive and negative space charge, i.e., as the products n of a characteristic macroscopic periodic polarization of the plasma. The basic assumption of the theory is the relative independence of the chain of processes in each dark or light region of the striations, so that interaction between the regions occurs as a result of the electric field of the space charge in the neighboring region. Equations are derived expressing the chronological order of the processes leading to the production of a space charge in each individual region and the interaction of the regions. The solution of the equations leads to functions some of which are in agreement with experimental data while others cannot be verified on the basis of the experimental material at present and require the carrying out of new experiments. (auth)

**11313**

SOLID-LIQUID AND LIQUID-LIQUID EQUILIBRIA OF THE TERNARY SYSTEM URANIUM HEXAFLUORIDE–CHLORINE TRIFLUORIDE–HYDROGEN FLUORIDE. G. P. Rutledge and W. Davis, Jr. (Union Carbide Nuclear Co., Oak Ridge, Tenn.). J. Phys. Chem. 63, 166-9(1959) Feb.

The complete condensed phase diagram of the ternary system $UF_6-ClF_3-HF$ has been determined. The measurements cover all possible compositions and temperature ranging from about −100 to +100°. The ternary eutectic temperature is −90° at a composition of 0.0 to 0.2 formula % $UF_6$, 19.5 formula % $ClF_3$, and 80.5 formula % HF. The lowest temperature at which the miscibility gap exists for two liquids saturated with solid $UF_6$ is 53° at a composition of 49 formula % $UF_6$, 13 formula % $ClF_3$, and 38 formula % HF. (auth)

**11314**

SIZE DISTRIBUTION OF RADIOACTIVITY OF THE NATURAL RADIOACTIVE DUST. Koji Kawasaki and Keiji Kato (Electrotechnical Lab., Nagatacho Chiyodaku, Tokyo). J. Phys. Soc. Japan 14, 234-5(1959) Feb.

An instrument designed for collecting natural radioactive dust in the atmosphere near the ground is described. Some results of measurements of the particle size distribution of the radioactivity of the particles are reported. It was found that most of the natural radioactivity in the atmosphere attaches itself to particles having radii in the range 0.1 to 0.04 micron, and predominance of the activity is in the vicinity of 0.0175 micron. (J.H.M.)

**11315**

REACTOR CRITICALITY AND NONNEGATIVE MATRICES. Garrett Birkhoff and Richard S. Varga (Harvard Univ., Cambridge, Mass. and Westinghouse Electric Corp., Pittsburgh). J. Soc. Ind. Appl. Math. 6, 354-77(1958) Dec.

The Perron-Frobenius theory of nonnegative matrices is applied to provide a mathematical basis for the physical concept of criticality and for typical computational interpretations of this concept. (W.L.H.)

**11316**

ATOMIC MICROBATTERIES. B. P. Sukhov. Nauka i Zhizn No. 7, 71(1958).

The utilization of atomic batteries as motive power for wrist watches is considered. (W.D.M.)

**11317**

X-RAY PENETRATION IN LEAD. J. W. Hubbell, E. Hayward, and W. F. Titus (National Bureau of Standards, Washington, D. C.). Nuclear Power 4, No. 35, 111(1959) Mar.

The energy and angular distribution of photons emerging from a 6 in. lead barrier exposed to 8 and 10 Mev bremsstrahlung from a 50 Mev betatron were determined. The pulse-height distributions produced by the transmitted photons were measured at 0, 5, 10, 20, 30, 40, 50, 60, and 70° to the beam direction. (W.D.M.)

**11318**

COMPUTING AID FOR REACTOR-KINETICS EQUATIONS. Henri Smets (Brookhaven National Lab., Upton, N. Y.). Nucleonics 17, No. 4, 104-5(1959) Apr.

A versatile graphical tool is given which can be used for all values of neutron lifetime and for a wide range of reactivities. It can be used to compute roots of the in-hour equation or the exact response to a ramp (exponential or inverse-function variation of reactivity). It also aids in computing the kernel of the integral equation of reactor kinetics. (T.R.H.)

**11319**

EFFECTIVE RANGE THEORY IN NUCLEON-ALPHA SCATTERING. G. Pisent and C. Villi (Univ. of Trieste and Istituto Nazionale di Fisica Nucleare, Trieste). Nuovo cimento (10) 11, 300-6(1959) Jan. 16.

An attempt is made to evaluate the scattering length and the effective range for N-$\alpha$ scattering up to states of orbital angular momentum L = 1. The extension of the method to higher momenta is straight forward. The results encourage the belief that a systematic application of the theory may be profitable in yielding information about the N-$\alpha$ potential relating the energy variation of the phase shifts to fundamental interactions. (A.C.)

**11320**

ON THE APPROACH OF ELECTRONS TO EQUILIBRIUM. S. L. Kahalas and H. C. Kashian (Sylvania Electric Products, Inc., Waltham, Mass.). Phys. Fluids 2, 100-2(1959) Mar.-Apr.

The relaxation of electrons to equilibrium in the absence of an external field is discussed for a slightly ionized gas in which elastic collisions predominate. The gas consists of electrons and neutral molecules having a Maxwellian interaction. Spatial diffusion is neglected as well as electron-electron interaction. The change of the electronic distribution function from a simple nonequilibrium distribution to a Maxwellian distribution is followed in time. Electron attachment to neutral molecules is briefly considered. (auth)

**11321**

OSCILLATIONS OF A FINITE COLD PLASMA IN A STRONG MAGNETIC FIELD. John Dawson and Carl Oberman (Princeton Univ., N. J.). Phys. Fluids 2, 103-11(1959) Mar.-Apr.

Of prime concern in plasma investigations is the coupling of a bounded plasma with external electromagnetic fields. The properties of the normal modes of a cold plasma slab and cylinder, situated in a strong magnetic field are derived, and then used to discuss the transmission and reflection of radiation, the scattering by a plasma cylinder, the response to driving sources in the vicinity of the plasma, and the radiation due to plasma oscillations. (auth)

**11322**

SOME EXACT SOLUTIONS OF THE NAVIER-STOKES AND THE HYDROMAGNETIC EQUATIONS. William C. Meecham (Univ. of Michigan, Ann Arbor). Phys. Fluids 2, 121-4(1959) Mar.-Apr.

Some exact, closed-form solutions of the Navier-Stokes equations for incompressible flow and of the hydromagnetic equations for high-conductivity, incompressible flow are presented. They can be considered to be generalizations of Taylor's solutions. The solutions are two dimensional and cellular containing a single-space Fourier component; the spatial behavior is chosen in such a way that the nonlinear inertial term and the pressure term cancel one another, leaving a linear system to be solved. The time behavior of the solutions is quite general. The solutions to the hydromagnetic equations are such that the velocity and the magnetic fields are parallel and decoupled. The velocity behaves as it does in the purely mechanical case while the magnetic field simply decays in time; there is no source term for it in the present treatment. (auth)

**11323**

EQUILIBRIUM STATISTICAL MECHANICS OF DISSOCIATING DIATOMIC GASES. Leon Heller (Los Alamos Scientific Lab., N. Mex.). Phys. Fluids 2, 147-52(1959) Mar.-Apr.

For the diatomic molecule AB in thermal and chemical equilibrium with its dissociated atoms, the pressure, density, specific entropy, and specific enthalpy are written as functions of the temperature and the fractional dissociation, with the approximations that the rotation is fully excited and there is no electronic excitation. These approximations are very good for many molecules over a large range of the variables. Atoms A and B can be either identical or distinct provided there is no excess of one atom over the other. For molecules composed of the isotopes of hydrogen, because of their large vibrational energies, it is possible to have considerable dissociation without vibration being important. If vibration is neglected, then the thermodynamic variables (written in dimensionless form) are related by equations which do not involve any properties of the species under consideration. Curves of constant pressure, density, specific entropy, and specific enthalpy are presented in the temperature-dissociation plane. The errors introduced by neglecting vibration are proportional to exp $(-T_V/T)$, where $T_V$ is the vibrational temperature. (auth)

**11324**

OPTICAL REFRACTIVITY OF HIGH-TEMPERATURE GASES. II. EFFECTS RESULTING FROM IONIZATION OF MONATOMIC GASES. Ralph A. Alpher and Donald R. White (General Electric Co. Research Lab., Schenectady, N. Y.). Phys. Fluids 2, 162-9(1959) Mar.-Apr.

Shock-tube studies of the optical index of refraction of ionized argon are described in which observed optical effects were related to the ionization of the shocked argon. The plasma dispersion formula was applied to the measured refractivities to determine values of equilibrium electron concentrations on the order of $10^{17}$ $cm^{-3}$. Good agreement is found between experimental and calculated values of the degree of ionization. The ionization relaxation process is strikingly portrayed in the interferograms and may be studied in some detail. Some questions concerning proposed kinetics for the relaxation behind strong shock waves in monatomic gases are discussed. (auth)

**11325**

INTERFEROMETRIC MEASUREMENT IN THE SHOCK TUBE OF THE DISSOCIATION RATE OF OXYGEN. D. L. Matthews (Princeton Univ., N. J.). Phys. Fluids 2, 170-8(1959) Mar.-Apr.

The dissociation of oxygen was observed behind shock waves at Mach 8 to 10, over a temperature range of 3000 to 5000°K. Photographs of the shocks were made using a Mach-Zehnder interferometer and a spark light source of effective duration 0.1 $\mu$sec. The velocity of the shock was measured using thin-film resistance thermometers to detect its passage. From this velocity and the state of the gas ahead of the shock, one can calculate the state of the gas behind the shock, both in the reaction zone and at equilibrium, from the interferometrically observed density ratios. Up to 12% equilibrium dissociation was obtained, following reaction zones of the order of 1 cm in length. The following rate constant, obtained from classical collision theory for the principal reaction $O_2 + O_2 \overset{kD}{\rightleftharpoons} 2O + O_2$, fitted the data well: $k_D = 7.4 \times 10^{11} PT^{1/2}(59,380/T)^3 \exp(-59,380/T)$ cc mole$^{-1}$ sec$^{-1}$, where 59,380 is the known dissociation energy of oxygen, expressed in degrees Kelvin. The quantity P, the "collision efficiency," was adjusted to fit the data, and was found to be 0.07. The data are consistent with the results of several other investigators who use different methods. The recombination rate constant calculated from the dissociation rate constant is $8.4 \times 10^{14}$ cc$^2$ mole$^{-2}$ sec$^{-1}$ at 3500°, and is approximately proportional to $T^{-2}$. (auth)

**11326**

TRIPLE-SHOCK-WAVE INTERSECTIONS. Joseph Sternberg (Ballistic Research Labs., Aberdeen Proving Ground, Md.). Phys. Fluids 2, 179-206(1959) Mar.-Apr.

In the Mach reflection of weak shock waves, there is a wide difference between theory and experiment for the shock wave angles at the triple point. Using the electric tank analogy in the hodograph to obtain the shock patterns it is found that the shock waves are so strongly curved near the intersection that the triple point angles cannot be observed in the laboratory. However, it is shown that the visible shock patterns are apparently inconsistent with the hodograph boundaries specified by the existing triple point theory. The effect of shock wave thickness on the boundary conditions at the triple point is then examined. It is shown that at the intersection there must be a non-Rankine-Hugoniot shock wave zone separating the three R-H shock waves. It follows that for weak shock waves where the shock curvatures $\rightarrow \infty$ at the triple point, the simple boundary conditions of equal pressure and direction are invalid for a real fluid. A semiquantitative description is then given of a real fluid model which is consistent with the experimental data and with the Navier-Stokes equations. The examination of this model reveals the formidable difficulties in the way of obtaining a detailed mathematical description of a triple shock wave intersection in a real fluid. The question of the solution for the limiting case as $\mu \rightarrow 0$ is also discussed. (auth)

**11327**

SHOCK-TUBE PERFORMANCE AT LOW INITIAL PRESSURE. Russell E. Duff (Los Alamos Scientific Lab., N. Mex.). Phys. Fluids 2, 207-16(1959) Mar.-Apr.

An electron beam densitometer was used to investigate the behavior of a conventional $1\frac{1}{8}$-in. ID shock tube operating at initial pressure of the order of 1 mm Hg. These experiments show that such a shock tube does not perform as predicted by simple theory. Most of the experiments were performed in argon with shock Mach numbers ranging between 1.2 and 7.0. The most striking observation was that for a given shock velocity, $M_s = 1.6$, the distance between the shock wave and contact surface as observed at the densitometer was proportional to initial pressure and independent of expansion chamber length over a tenfold range of tube length. At an initial pressure of 0.5 mm Hg the time interval between the arrival of the shock and the contact surface varied between 600 µsec at $M_s = 1.2$ and 20 µsec at $M_s = 7.0$. The diaphragm pressure ratio (Ar—Ar) required to produce a shock of velocity $M_s = 1.6$ varied from 200 at an initial pressure of 0.25 mm Hg to 20 at an initial pressure of 50 mm Hg. For a given diaphragm pressure ratio the shock velocity decreased with distance in a highly nonlinear manner. The density behind the shock wave was observed to increase significantly before the arrival of the contact surface under all conditions. This surprising shock-tube behavior is believed to be related to severe laminar boundary layer development behind the shock wave at low initial pressures. (auth)

**11328**

THE SOLAR BATTERY. V. Shchekin. Radio No. 8, 29-30(1958).

The maximum output capacity of silicon elements is 10 to 12 milliwatts/cm$^2$ of photosensitive surface area. The efficiency of present-day silicon elements is 11 to 13% compared to 1% with other materials and the maximum efficiency of 22%. The "Sputnik" radio was powered from a solar battery of 5 v and fitted with a miniature TsNK-0.4 storage battery. It is calculated that to supply electricity for lighting a small flat or house at 110 v, 3 amp, a solar battery of 2 × 2 m would be sufficient. (W.D.M.)

**11329**

INVESTIGATION OF THE FIELD EMISSION OF LANTHANUM HEXABORIDE. M. I. Yelinson and G. F. Vasil'yev. Radiotekh. i Elektron. 3, 945-53(1958).

Work is described that was aimed at the investigation of the field emission of $LaB_6$. The mechanism of the emission, the adsorption properties, and chemical stability when subjected to ion bombardment are discussed. Samples were in the form of bars having dimensions 1.5 × 1.5 × 20 mm. (W.D.M.)

**11330**

EMISSION CHARACTERISTICS OF THE OXIDES OF RARE-EARTH METALS. B. S. Kul'varskaya, V. B. Marchenko, and G. V. Stepanov. Radiotekh. i Elektron. 3, 1005-9(1958).

Some experimental data on thermionic and secondary electron emission of various rare earth oxides are given. The investigations were carried out on thin layers having a thickness of several thousand angstroms. The dependence of the secondary electron emission coefficient on the velocity of the primary electrons, collector potential, and the incidence angle of the primary electrons were measured. (W.D.M.)

**11331**

THE IMPOSSIBILITY OF RAREFACTION SHOCK WAVES IN MAGNETIC HYDRODYNAMICS. R. V. Polovin and G. Y. Lubarskii (Kar'kov State Univ.). Ukrain. Fiz. Zhur. 3, 571-4(1958) Sept.-Oct. (In Ukrainian)

It is shown that rarefaction shock waves are impossible in magnetic hydrodynamics if the adiabatic compression decreases with an increase in pressure, and if, at constant volume, an increase in temperature causes an increase in pressure. The magnetic field increases if the shock wave is fast and decreases if it is slow. (auth)

**11332**

ELECTROMAGNETIC WAVE PROPAGATION IN MOLECULAR CRYSTALS WITH WEAK EXCITON-PHONON INTERACTION. I. ABSORPTION AND DISPERSION OF ELECTROMAGNETIC WAVES. A. F. Lubchenko. Ukrain. Fiz. Zhur. 3, 575-86(1958) Sept.-Oct. (In Ukrainian)

The absorption and dispersion of electromagnetic waves in molecular crystals in which excitons may be formed with weak coupling of the exciton excitation with the lattice vibrations and at an arbitrary value of the absorption coefficient ($\varkappa$) were studied. The energy operator of the interaction between the electromagnetic wave and the crystal is selected, and the wave vector Q of the wave propagated in the crystal is regarded as complex. The wave function describing the excited state of the crystal is found, and the electrical moment of a crystal unit volume is computed. It is assumed for simplicity of calculation that the exciton zone in question is distant from the other zones, and that the polarization, due to transitions to all other states except the one under examination, is thus equal to $(\epsilon - 1/4\pi)$ E, where the dielectric constant tensor $\epsilon$ depends only to a slight extent on the frequency. The expression for polarization, in conjunction with the Maxwell equations, permits obtaining a simple system of equations for determining the index of refraction n, $\varkappa$, and E. The system is solved for monoclinic crystals, when the transition occurs in a state, the wave function of which is transformed by the same irreducible representation as is the z-component of the polar vector. (auth)

**11333**

ON THE SCATTERING OF ELECTROMAGNETIC WAVES ON HETEROGENEITIES DUE TO TURBULENT PULSATIONS UNDER NON-STATIONARY TURBULENT CONDITIONS. V. L. German (Inst. of Radiophysics and Electronics, Academy of Sciences, Ukrainian S.S.R.). Ukrain. Fiz. Zhur. 3, 617-23(1958) Sept.-Oct. (In Ukrainian)

The effects of nonstationary turbulent conditions on the scattering of electromagnetic waves by heterogeneities of the dielectric constant induced by the turbulency are analyzed. (R.V.J.)

**11334**

EFFECTS OF MAGNETIC FIELDS ON THE PENETRATING PLASMA FOR OBTAINING INTENSE IONIC BEAMS. M. D. Gabovich (Inst. of Physics, Academy of Sciences, Ukrainian S.S.R.). Ukrain. Fiz. Zhur. 3, 693-5(1959) Sept.-Oct. (In Ukrainian)

It is shown that magnetic fields influence the construction of plasmas. The data indicate the possibility of utilizing the magnetic field influence in obtaining primary ion focusing from the plasma boundary. (R.V.J.)

**11335**

ENERGETIC DISTRIBUTION OF ELECTRON STATES ON A GERMANIUM SURFACE. N. S. Chornaya (Inst. of Physics, Academy of Sciences, Ukrainian S.S.R.). Ukrain. Fiz. Zhur. 3, 760-4(1958) Nov.-Dec. (In Ukrainain)

The energetic distribution of surface levels was studied on a $\rho$-type gallium-alloyed germanium surface etched in $H_2O_2$ ($\rho = 25$ ohm cm). The measurements were carried out in an ultra-high vacuum $P \sim 1$ to $2 \times 10^{-9}$ mm Hg. The experimental results indicate that in the investigated interval of the forbidden zone there exists one acceptor and one donor surface level. With a change in $W_0$, there is a change in the surface level distribution in respect to the $E_f$ level. The effectiveness of any given surface level is due to this. In the temperature interval $243°K < T < 267°K$ the modulation weakening factor $\eta$ is great, and two types of levels are observed: a donor and an acceptor. At temperatures below 240°K, $\eta$ constitutes several units, only one type of level (the donor) is noted. These facts agree with the theoretical ideas. (auth)

**11336**

TRANSFER EQUATIONS FOR RADIATION FIELD INTEGRAL FUNCTIONS. V. A. Prokof'ev. Vestnik Moskov. Univ. Ser. Mat. Mekhan. Astron. Fiz. i. Khim. 13, No. 3, 39-45(1958). (In Russian)

A generalized transformation for semi-spherical and spherical integral functions was developed for the case of laminar media (where all functions in the transition equation depend on only one coordinate X). (R.V.J.)

**11337**

THE BREAKDOWN FREQUENCY IN GASES IN A WIDE DECIMETRIC FREQUENCY RANGE. II. G. A. Anashin. Vestnik Moskov. Univ. Ser. Mat. Mekhan. Astron. Fiz. i Khim. 13, No. 3, 69-74(1958). (In Russian)

Minimum resonance breakdown characteristics were studied in a wide frequency range. Verifications were made of the equation $\omega_b = (e \cdot H/mc) = \omega$ (where H is the magnitude of the applied magnetic field, $\omega$ is the electric field circular frequency, and $\omega_b$ is the circular frequency of electron conversion) in applications to the coaxial waveguide nonuniform field. The effects of stable negative ion formation in electrically negative gases and of the field frequency on the breakdown characteristics were determined. (R.V.J.)

**11338**

ON THE LUMINESCENCE OF CRYSTALS. V. L. Broude, A. F. Prikhot'ko, and E. I. Rashba. Uspekhi Fiz. Nauk 67, 99-117(1959) Jan. (In Russian)

The luminescence processes related to excitation mechanisms in crystals are analyzed. The luminescence scheme of ideal and mixed crystals, the luminescence of crystals at low temperatures, and the quasi-equilibrium distribution in excitation states are discussed. 75 references. (R.V.J.)

**11339**

EXPERIMENTAL WORK WITH $He^3$. V. P. Peshkov and K. N. Zinov'eva. Uspekhi Fiz. Nauk 67, 193-244(1959) Feb. (In Russian)

A review is given on experimental work with $He^3$. The methods of $He^3$ segregation, the elasticity of saturated vapor, the critical point and thermonuclear pressure differences in $He^3$, the density of liquid, vapor, or solid $He^3$, and the heat capacity, entropy, and viscosity are analyzed, as well as temperature jumps at a $He^3$ boundary with solid media, the sound range, and compression and adsorption properties. Descriptions are also given of creostats for use with $He^3$. 110 references. (R.V.J.)

**11340**

INVESTIGATIONS OF THE HIGH-FREQUENCY SPECTRA OF PERIODIC DISCHARGES. Werner Heintz (Physikalisch-Technische Bundesanstalt, Brunswick). Z. angew. Phys. 11, 51-7(1959) Feb. (In German)

Corona discharges at high voltage show, on an oscilloscope, discharge pulses of various sizes. A study was made of a single peak in these discharges. The spectrum of the almost periodically occurring Trichel pulses was measured with a high-frequency spectrometer. With the help of Fourier transformations the pulse form leading to this spectrum is obtained. The form of the current pulses are in direct relationship with the solution of the diffusion differential equation which describes the discharge pattern. In the measurement of the spectrum the switch elements filtered by the current pulses are considered. A general relationship between the measured spectrum and the pulse spectrum before entry into the measuring apparatus is formulated and given specifically for the arrangement used. The experimental method represents a partial analysis of the spectra from spark interference voltages. (tr-auth)

**11341**

THE DETERMINATION OF LEAD IN LEAD GLASSES

BY THE REFLECTION OF $\beta$-RADIATION. V. B. Gaydadymov and L. I. Il'ina. Zavodskaya Lab. 24, 431-4(1958).

A method for determining lead in lead glass is described. An ionization chamber was used as a recording device, and $Tl^{204}$ served as a radiation source because of its greater decomposition period, high maximum energy, and purity of radiation. An accuracy of 0.2% was obtained at a PbO content of 30%. (TCO-W.D.M.)

**11342**
A REVIEW OF SOVIET WORKS ON THE PHOTOGRAPHIC ACTION OF IONIZING PARTICLES. A. L. Kartuzhanskii and B. P. Soltitskii. Zhur. Nauch. i Priklad. Fot. i Kinematografii 3, 299-306(1958).

The works by Soviet scientists dealing with the basic principles of the photographic method and the nature of the ionizing action of particles are reviewed. The development of new emulsions for use in nuclear physics is discussed. Theory is covered by works dealing with the mechanism of the emulsion, energy loss of particles, latent image formation, etc. (TCO-W.D.M.)

**11343**
ON THE MECHANISM OF THE INTERACTION OF CHARGED PARTICLES WITH CRYSTALS. K. S. Bogomolov. Zhur. Nauch. i Priklad. Fot. i Kinematografii 3, 388-9(1958).

In the ionization process, interaction of electrons with lattice defects occurs with loss of energy which, in an ideal lattice, would be used for the liberation of electrons of conductivity. Energy losses by charged particles are thus due to loss of energy by the electrons and not to loss of electrons. (W.D.M.)

**11344**
TEKHNOLOGIYA VYSOKOGO VAKUUMA. (High Vacuum Technology.) Janusz Groszkowski. Translation of "Technologia wysokiej próżni. 2nd ed." Moscow, Izd-vo inostrannoy lit-ry, 1957. 539p.

This book is intended for physicists, engineers, personnel of scientific research laboratories, and industries using vacuum systems and their components. Modern methods of obtaining and measuring a high vacuum are described. The working principles of various pumps and manometers, structural layout of joints and seals in a vacuum system, and materials used in vacuum technology are discussed in detail. (W.D.M.)

## Elementary Particles

**11345** CNC-7
Italy. Comitato Nazionale per le Ricerche Nucleari. Divisione Sviluppo Reattori, Rome.
CINETICA DEI NEUTRONI LENTI IN UNO SPETTROMETRO A TEMPO DI VOLO. II. PROBABILITÀ DI TRANSMISSIONE ATTRAVERSO UNA FENDITURA RUOTANTE E DISTRIBUZIONE DOPO IL VOLO DI NEUTRONI CON SPETTRO DI VELOCITÀ F (V). (Kinetics of Slow Neutrons in a Time-of-flight Spectrometer. II. Probability of Transmission Across a Rotating Slit and Distribution after the Flight of Neutrons with Velocity Spectrum F (v.) M. Marsequerra and G. Pauli. Dec. 1958. 11p.

On the basis of the results obtained in Part I (CNC-1), expressions are derived for the transmission probability through a revolving curved slit for neutrons having a velocity distribution f(v), the distribution shown by the neutrons after the flight, and the uncertainty in the energy of neutrons detected in an infinitesimal time interval. (auth)

**11346** AEC-tr-3616
BOUND STATES AND SCATTERING OF BARYONS DURING CONTACT INTERACTION. (Cvyazannye Sostoyaniya i Rasseyanie Barionov pri Kontaktnom Vzaimodeistvii.) I. V. Polubarinov. Translated by Lydia Venters (Argonne National Lab.) from a publication of the Joint Inst. of Nuclear Research. Lab. of Theoretical Physics, Dubna, U.S.S.R., 1958. 26p. \$4.80(ph), \$2.70(mf) JCL or LC.

The possibility of describing $\pi$ and K mesons as bound states in the theory of four-baryon interactions is discussed. In the framework of this theory in chain approximation the cross sections of the scattering of baryons on baryons are obtained. The question of validity in application of the perturbation theory for the cross sections of the first approximation is discussed. (auth)

**11347**
SELF AND EXTERNAL MESON FIELDS. R. T. Sharp (McGill Univ., Montreal). Can. J. Phys. 37, 515-20 (1959) Apr.

Instead of a single (isotopic vector) field to describe pions, it is sometimes advantageous to introduce several such fields with identical properties except for their coupling to the sources of the field (the baryons). In this way one can formally distinguish between self pions (roughly, those which can be emitted and absorbed by the same baryon) and external pions (roughly, those which are only exchanged between baryons or emitted into or absorbed from free states). K-mesons can be treated similarly. The device, which is of general applicability, simplifies many derivations and calculations in quantum field theory. As an illustration of the method it is used to derive the Low equations for scattering of pions and K-mesons by nucleons and for associated production. A suggestion is made for treating the nucleon-nucleon interaction. (auth)

**11348**
ON THE ANISOTROPY OF A HETEROGENEOUS MEDIUM WITH RESPECT TO THE DIFFUSION OF NEUTRONS. II. Ladislav Trlifaj (Inst. of Nuclear Physics, Czechoslovak Academy of Sciences, Prague). Czechoslov. J. Phys. 7, 523-32(1957).

The anisotropy of neutron diffusion in a stratified heterogeneous medium with (total) cylindrical and spherical symmetry was investigated. The homogenization of stratified heterogeneous medium which scatters the neutrons anisotropically for each elementary scattering event was calculated. The plane source at infinity is at the same time parallel to the layers. (auth)

**11349**
ATTENUATION OF 14-Mev NEUTRONS IN WATER AND IN 6-IN. LEAD AND WATER. V. P. Duggall, S. M. Puri, and K. Sri Ram (Atomic Energy Establishment, Trombay, India). Nuclear Sci. and Eng. 5, 199-200 (1959) Mar.

Curves of dose rate as a function of distance were prepared from measurements made with indium and phosphorus detectors in water and in water faced with 6 inches of lead. (D.E.B.)

**11350**
NOTE ON THE THERMAL NEUTRON SPECTRUM IN A DIFFUSING MEDIUM. G. de Coulon and P. F. Zweifel (Univ. of Michigan, Ann Arbor). Nuclear Sci. and Eng. 5, 203-4(1959) Mar.

The energy-dependent thermal diffusion equation in a region free of external sources is considered. The suggestion is made that certain problems raised should be answered experimentally before parameters measured either by relaxation or pulsed techniques are used in reactor design. (A.C.)

**11351**

A SYSTEMATIC STUDY OF HYPERFRAGMENTS PRODUCED BY 4.5 GeV $\pi^-$ IN NUCLEAR EMULSION. I. $\pi^-$-MESIC DECAYS. W. E. Slater (Univ. of Chicago). Nuovo cimento (10) 10, Suppl. No. 1, 1-40(1958).

The experiment was undertaken to establish the Λ-particle binding energies ($B_\Lambda$) for several hypernuclides. Only events best suited to yield binding energies are considered, namely, those in which a negative pion is emitted. The methods of detection and analysis employed are described. Sources of error are discussed, and binding energies are presented together with some collateral results. Descriptions of the measurements together with an estimate of experimental errors and an account of identification methods are presented in an appendix. The binding energies are in good agreement with other results. (A.C.)

**11352**

A SYSTEMATIC STUDY OF HYPERFRAGMENTS PRODUCED BY 4.5 GeV $\pi^-$ IN NUCLEAR EMULSION. II. NON-MESIC DECAYS. E. M. Silverstein (Univ. of Chicago). Nuovo cimento (10) 10, Suppl. No. 1, 41-67 (1958).

Events involving decays without the visible emission of a pion are much harder to identify as genuine hyperfragments than those involving a negative pion. Slater has described the mesic decays of an emulsion experiment specifically designed to observe large numbers of hyperfragments under homogeneous conditions of production and detection. The present investigation, conducted to remedy the situation described above, concerns the nonmesic hyperfragments obtained in the same experiment. Among 272 events 44 were identified, with some degree of uniqueness, as specific hypernuclides. (A.C.)

**11353**

A RE-ANALYSIS OF THE EXPERIMENTAL DATA ON HYPERNUCLEI DECAYING BY $\pi^-$ EMISSION. R. Levi-Setti, W. E. Slater, and V. L. Telegdi (Univ. of Chicago). Nuovo cimento (10) 10, Suppl. No. 1, 68-90(1958).

A final version of a preliminary report prepared in 1957 with the purpose of summarizing the data available on the basis of a critical reanalysis of individual events is presented. Essentially no new material is included, but a detailed description of the salient features of the events considered and of the criteria adopted is presented. Experimental data are presented in 9 tables. (A.C.)

**11354**

POLARIZATION PHENOMENA IN PHOTOELECTRIC EFFECT AND ONE QUANTUM ANNIHILATION OF POSITRONS IN THE K-SHELL. H. Banerjee (Indian Inst. of Tech., Kharagpur). Nuovo cimento (10) 11, 220-8(1959) Jan. 16.

Polarization effects in the cross sections for both the photoelectric and the positron annihilation processes in the K-shell were investigated by the Stokes parameter method for arbitrary polarization of the incident particles. The scattering states of the electron and the positron were approximated by Sommerfeld-Maue wave functions. Results were obtained correctly up to terms of O(a) and neglecting terms of O(a/ϵ), where a = Z/137 and ϵ is the energy of the scattering state in units of $mc^2$. It was found for either case that in the first approximation there is correlation only between the circular polarization of the photon and the component of the polarization vector of the free Dirac particle in the plane of scattering. In the high energy limit, the ratio of the degree of circular polarization of the incident (emitted) radiation and the degree of longitudinal polarization of the photoelectron (positron) tends to unity. (auth)

**11355**

DISPERSION RELATIONS FOR PION PRODUCTION IN A PION-NUCLEON COLLISION. G. R. Screaton (Univ. of Edinburgh). Nuovo cimento (10) 11, 229-52(1959) Jan. 16.

The dispersion relations for pion production are written down in terms of sixteen invariant functions and it is shown that the bound state terms can be evaluated from a knowledge of the dispersive part of pion-nucleon scattering. (auth)

**11356**

LONGITUDINAL POLARIZATION OF THE FAST NEUTRONS FROM $\mu^-$ ABSORPTION BY NUCLEI. M. Cini and R. Gatto (Univ. of Rome and Istituto Nazionale di Fisica Nucleare, Rome). Nuovo cimento (10) 11, 253-61(1959) Jan. 16.

The longitudinal polarization of the fast neutron emitted in the absorption of a negative muon by a nucleus is calculated for the A ± V interaction using a Fermi model for the nucleus. It is shown that, as long as this model can be applied to describe the process, the emitted neutron has an appreciable longitudinal polarization if the interaction is A−V. Rescattering corrections are estimated using an optical model and it is found that they do not alter these conclusions for the neutrons in the upper part of the spectrum. (auth)

**11357**

MESON MASS SPECTRUM. K. M. Guggenheimer (Univ. of Glasgow). Nuovo cimento (10) 11, 287-8 (1959) Jan. 16.

Extended particles can possess an angular momentum as well as an intrinsic spin s. The energy can be expected to be a function of l(l + 1) and of s(s + 1) and may assume the simple form $E/C^2 = a[l(l+1) + s(s+1)]m_e$. The lightest meson is the μ meson with mass m = 207 $m_e$. If the quantum numbers l = 1 and s = ½ are used, the following equation is obtained: $a = {}^{207}/_{2.75} = 75.27$. The calculated mass values are tabulated and compared with observed values. Good agreement was found. (A.C.)

**11358**

ON THE MASS OF ELEMENTARY PARTICLES. A. Carrelli (Univ. of Naples). Nuovo cimento (10) 11, 289-90(1959) Jan. 16.

Articles have recently been published by Fröhlich and Nambu concerning a modern theory on elementary particles which should give a theoretical value of their masses. An attempt is made to discover a "Balmer formula" pending the discovery of a theory capable of explaining it. A formula is proposed by Fröhlich for N from which values of N may be obtained according to the position selected. This does not have the character of a Balmer formula. (A.C.)

**11359**

CALCULATIONS OF EFFECTIVE LEAD ABSORBER. V. M. Mal'tsev (Joint Inst. of Nuclear Research, Dubna, U.S.S.R.). Pribory i Tekh. Ekspt. No. 1, 28-32(1959) Jan.-Feb. (In Russian)

Calculations were made of an effective 0.1 to 0.7 cm thick lead converter for the energy range from 50 to 500 Mev. Two generations of cascade processes were studied, and the effects of multiple scattering angular spread and energy losses of charged particles leaving the converter were estimated. (R.V.J.)

**11360**
RELATIVISTIC PARTICLE ENERGY DETERMINATION BY MEASURING THE MULTIPLE COULOMB SCATTERING. I. Ya. Chasnikov, Zh. S. Takibaev, and E. G. Boos (Inst. of Nuclear Physics, Academy of Sciences, Kaz S.S.R.). Pribory i Tekh. Ekspt. No. 1, 54-7(1959) Jan.-Feb. (In Russian)

Determination of high-energy particle pulses by measuring Coulomb scattering in emulsion is described. The results show that the method permits the determination of particle energy up to 20 Bev with 4 to 5 cm paths. (tr-auth)

**11361**
DECAY PROPERTIES OF HEAVY MESONS AND HYPERONS. E. O. Okonov. Uspekhi Fiz. Nauk 67, 245-91(1959) Feb. (In Russian)

Data on K meson and hyperon investigations developed during the last two years are reviewed. The data confirm the Gell-Mann prediction of $\Sigma^0$ hyperon ( $t_{\Sigma^0} < 10^{-15}$ sec) decay into a $\Lambda^0$ particle and a $\gamma$ quanta. The first direct indications were found of the existence of the $\Xi^0$ hyperon also predicted by the charged multiplet shift schemes. The long-lived $K_2^0$ particle (described by Gell-Mann, Pais theory) with decay properties different from the known $K^0$ was discovered, and the existence of $K^0 \to \overline{K}^0$ transition in vacuum (the Pais-Piccioni) was confirmed experimentally. The nonconservation of space parity and invariance to the charge conjugate is exhibited both in hyperon and $\beta$ decay. $\tau$ and $\Theta$ mesons were verified as one and the same particle decaying in different ways with a violation of parity. An event was recorded of a charge analog of $\Lambda^0$ decay, the $\overline{\Lambda}^0$ decaying into an antiproton and $\pi$ meson. All the above data were obtained on accelerators except the $\Xi$ hyperon data, which were obtained from cosmic radiation. However, the latest data mention two events of $\Xi$ production and decay observed in a propane-bubble chamber exposed to a 5.5 Bev/c bevatron $\pi$ meson beam. 293 references. (R.V.J.)

**11362**
DIRAC PARTICLE SCATTERING ON SPHERICAL SYMMETRIC POTENTIAL IN THE THEORY OF ATTENUATION. I. I. Guseinov. Vestnik Moskov. Univ. Ser. Mat. Mekhan. Astron. Fiz. i Khim. 13. No. 3, 151-60(1958). (In Russian)

An analysis was made of Dirac particle scattering by a stationary, spherical symmetric force center with a small range of action. (R.V.J.)

## Heat Transfer and Fluid Flow

**11363** AERE-ED/M-22
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
A REVIEW OF NET BOILING HEAT TRANSFER AND PRESSURE DROP FROM THE LITERATURE. H. A. Roberts. Aug. 1955. 45p.

An account is given of the present state of knowledge with regard to heat transfer, critical heat flux and temperature, pressure drop, relative velocities of steam and water, and the onset of unstable flow for the net boiling of water at high pressures according to the literature. Working formulas and curves are suggested for use in the absence of experimental evidence. (auth)

**11364** AFOSR-TN-58-427
Maryland. Univ., College Park. Inst. for Fluid Dynamics and Applied Mathematics.
SELECTED TOPICS FROM THE THEORY OF GAS FLOW AT HIGH TEMPERATURES (V). THE APPLICATION OF TRANSFER EQUATIONS TO THE CALCULATION OF DIFFUSION, HEAT CONDUCTION, VISCOSITY AND ELECTRIC CONDUCTIVITY. Technical Note BN-124 a. J. M. Burgers. May 1958. 64p. Contract AF18(600)-993. (AD-158230).

The equations of transfer are deduced from the Maxwell-Boltzmann equation, in the form in which this is known for binary collisions. The results have been given in a form with all terms complete, including those depending upon electric and magnetic forces. Part I brings the deduction of the transfer equations. Part II gives applications to the calculation of the coefficients of diffusion in first and second approximation, including thermal diffusion, of heat conduction, of viscosity, of electric conductivity, and of temperature exchange between the constituents of a gas mixture. Although attention mainly has been directed to binary mixtures, the expressions are presented in such a way that extension to multi-component mixtures is possible. Particular attention is given to the influence of a homogeneous magnetic field upon electric conductivity and upon viscosity. (auth)

**11365** BNL-2433
Brookhaven National Lab., Upton, N. Y.
HEAT TRANSFER AND FLUID DYNAMICS IN MERCURY-WATER SPRAY COLUMNS. R. D. Pierce, O. E. Dwyer, and J. J. Martin. [1955?]. 39p. $6.30 (ph), $3.00(mf) OTS.

Heat transfer and fluid dynamics were studied in columns spraying hot mercury into rising streams of water. Volumetric and area heat transfer coefficients are presented. These coefficients are lower than those reported for heat transfer from fixed spheres. The major flow of water bypassed the drops while water surrounding the drops flowed downward. The principal heat transfer resistance appears to lie between these rising and falling water streams. Outlet mercury temperature did not approach inlet water temperature as a limit because the flow patterns caused a discontinuous rise in the water temperature at the bottom of the columns. (auth)

**11366** UCRL-8602
California. Univ., Berkeley. Lawrence Radiation Lab.
A NEW CORRELATION FOR MASS TRANSFER IN THE FLOW OF GASES THROUGH PACKED BEDS AND FOR THE PSYCHROMETRIC RATIO. Edward J. Lynch and Charles R. Wilke. Feb. 10, 1959. 31p. Contract W-7405-eng-48. $1.00(OTS).

A new method is proposed for the correlation of mass transfer in the flow of gases through packed beds. This method is based on an empirical extension of the equations of Lin, Moulton, and Putnam and von Karman. The proposed equation agrees well with data on the vaporization from solids over a range of Schmidt numbers from 0.24 to 3.15. Modifications of the proposed equation appear to be applicable to mass transfer in packed columns with liquid flow and to psychrometric work. More extensive data will be necessary to confirm the suitability of these applications. (auth)

**11367** WAPD-T-653
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
MIXING IN RECTANGULAR NUCLEAR REACTOR CHANNELS. Adopted from the thesis: MASS TRANSFER BY EDDY DIFFUSION IN THE WIDE DIRECTION OF A RECTANGULAR CHANNEL. R. J. Slember. Jan. 1958. 57p. $9.30(ph), $3.60(mf) OTS.

Submitted to Pittsburgh. Univ.

Data on mixing by eddy diffusion in the wide direction of a rectangular channel were obtained under conditions of steady flow and for Reynolds' numbers in the range of 40,000 to 150,000. The test section consisted of a rectangular channel approximately 10 ft long, four in. wide, and a thickness which could be set at 0.1 or 0.2 in. The test procedure involved the measurement of the spread of a dye solution injected into the turbulent stream. The dye was introduced at various positions across the wide direction of the channel, and samples were withdrawn downstream by a number of probes. The eddy diffusivity for mass was then determined from the measured concentrations of dye in the samples by comparing the test data with analytical solutions for the dye diffusion. These solutions were obtained treating the dye as diffusing from a finite rather than a point source. A series of normalized analytical curves presenting the solutions is included. (auth)

**11368** AERE-Lib/Trans-813
HEAT TRANSFER IN SURFACE BOILING OF WATER. P. G. Poletavkin and N. A. Shapkin. Translated by J. B. Sykes (U.K.A.E.A.) from Teploenergetika 5, 49-54(1958). 12p.

New experimental results on surface boiling are given and compared with previous results. The vertical experimental section was a stainless steel tube of internal diameter 5.6 mm, 225 mm long. The tests on heat transfer and steam quality were made simultaneously. Measurements were made on the tube wall temperature at three places along its length. Tests were run at pressures of 7.16 and 41 atm, heat flow rates of up to $2.5 \times 10^6$ kcal/m$^2$hr, underheating of 3 to 120°C, and circulation rates of 0.7 to 11.5 m/sec. (W.D.M.)

**11369** NASA-RE-2-8-59W
WALL TURBULENCE. Carlo Ferrari. Translated by R. H. Cramer from Section C of Corso sulla teoria della Turbolenza. Casa Editrice Cremonesi, Rome, 1957. 133p.

Available from NASA.

A theoretical study was made of the factors affecting the development of a turbulent flow in the presence of a solid wall, with a view to obtaining a better understanding of the problem. The basic set of governing relationships as set forth are not sufficient in themselves to provide the much sought after solution to the turbulent flow problems, but when used with certain simplifying assumptions they do permit a careful study of some simple cases of wall turbulence, such as a flat plate with or without a uniform pressure gradient or flow in a uniform channel. Also included is a brief discussion of the works of other authors which may lead to a sound rational basis for future work on wall turbulence. (auth)

**11370**
BOILING EFFECTS IN LIQUID-COOLED REACTORS. H. A. Roberts and R. W. Bowring (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nuclear Power 4, No. 35, 96-101; 118(1959) Mar.

In the second of a two-part article, boiling heat transfer is dealt with. The effects of various types of boiling, recent correlations for calculating fuel element temperatures, and reactor safety limits set by burnout are considered. (W.D.M.)

**11371**
TIME CONSTANT OF CYLINDRICAL FUEL PIN WITH AXIAL COOLANT FLOW. H. A. Sandmeier and D. M. O'Shea (Argonne National Lab., Lemont, Ill.). Nuclear Sci. and Eng. 5, 186-9(1959) Mar.

From the time dependent heat conduction and temperature distribution, an expression is derived for the time constant in a cylindrical fuel pin and cladding with axial coolant flow. The power production and the inlet temperature are functions of time. In the radial direction perfect mixing of the coolant is assumed. The average coolant temperature in a region is the average between inlet and outlet temperature assuming a linear rise in the axial direction. The set of partial differential equations can be solved by means of Laplace transform. The reciprocal of the roots of the characteristic equation for the temperature in the transform domain represents the time constants. The smallest root represents the dominant transient time constant. This dominant time constant is compared with a qualitative expression for the thermal relaxation time of a reactor after a power change given by Bethe. The numerical example used is a fuel pin in EBR-I Mark III in flowing NaK coolant at a core power generation of 1 Mw at various coolant flow conditions. (auth)

**11372**
PLASTIC BENDING OF RODS OR TUBES WITH RADIAL TEMPERATURE DISTRIBUTIONS. K. R. Merckx (General Electric Co., Richland, Wash.). Nuclear Sci. and Eng. 5, 202-3(1959) Mar.

Horizontally loaded reactor fuel elements are subject to bending stresses which limit the distance between fuel element supports. Since these fuel elements have radial temperature distributions, standard analysis can not be used to determine the deflections. The necessary equations are given to extend existing methods of plastic bending analysis to cases of rods or tubes with radial temperature distributions. (A.C.)

**11373**
INHIBITION OF HYDRODYNAMIC INSTABILITY BY AN ELECTRIC CURRENT. Chia-Shun Yih (Univ. of Michigan, Ann Arbor). Phys. Fluids 2, 125-30(1959) Mar.-Apr.

The inhibition of instability of a viscous fluid contained in a circular cylinder and heated from below by an electric current is investigated. Previous results indicate that, for a thermally nonconducting wall, the critical Rayleigh number is 452.1 for symmetric convection, and 67.9 for the first (and critical) mode of unsymmetric convection. It was found that unsymmetric convections can be delayed or completely inhibited by an electric current, whereas symmetric convection is not at all affected. This indicates a very interesting physical situation at Rayleigh number 452.1, for an electric current just strong enough to inhibit unsymmetric convection. If the current is slightly increased, only symmetric motion will occur. If it is slightly decreased, unsymmetric convection, being more unstable, will prevail. Thus the physically significant solution of a differential system may have a sudden change of behavior at certain critical values of its parameters. (auth)

**11374**

THE DETERMINATION OF THE WETNESS OF STEAM AT HIGH PRESSURES. A. V. Ratner and V. G. Zelenskii. Teploenergetika No. 5, 44-6(1958).

Work to determine the flow factor for a Venturi tube operating on hot water and wet steam at pressures of 160 to 170 atm is described. The experimental setup is shown. The equipment and its calibration are discussed along with the experimental procedure and precautions. The difference between the steam contents determined from the heat balance of the steam cooler and from the measurement on the heat exchanger was ±0.05. Various formulas used in working out the results are given. (W.D.M.)

## Nuclear Properties and Reactions

**11375** AERE-HP/R-2744

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

FAST NEUTRON DOSIMETRY USING NUCLEAR EMULSIONS. J. E. Cook. Dec. 1958. 30p.

Proton recoils produced by collision of fast neutrons with the hydrogen of the emulsion, or in material surrounding the emulsion, are visible as tracks in the developed emulsion examined microscopically. Factors involved in errors in dose evaluation are discussed. Properties of the fast neutron pack developed at AERE are given. (W.D.M.)

**11376** CF-58-6-83

Oak Ridge National Lab., Tenn.

REMOTE MAINTENANCE TOOLS CATALOG NO. 58. [1958]. 135p. Contract [W-7405-eng-26]. $25.80(ph), $7.80(mf) OTS.

Catalog number 58, containing information concerning remote maintenance tools which have been used at ORNL, is presented. It is intended as a guide and as a starting point for modification work. Complete information is not available on all tools. (J.R.D.)

**11377** CF-59-1-70

Oak Ridge National Lab., Tenn.

ABSOLUTE MEASUREMENT OF ETA BY THE MANGANESE BATH TECHNIQUE. G. deSaussure and R. L. Macklin. Jan. 20, 1959. 11p. Contract [W-7405-eng-26]. $3.30(ph), $2.40(mf) OTS.

An experiment is described for measuring $\eta$ of $U^{233}$ and estimating the various errors involved. A value for $\eta$ can be obtained with a precision of 1% or better. (auth)

**11378** CNI-6

Italy. Comitato Nazionale per le Ricerche Nucleari, Milan.

ACTIVATION CROSS SECTIONS OF $Er^{162}$ AND $Er^{164}$. G. Segre. Jan. 1959. 9p.

The thermal neutron activation cross sections of $Er^{162}$ and $Er^{164}$ were evaluated by using an enriched isotopic mixture. The cross sections were 2.03 and 1.65 b, respectively. (J.E.D.)

**11379** LA-1190(Del.)

Los Alamos Scientific Lab., N. Mex.

THE DD AND TD CROSS SECTIONS. J. L. Tuck. May 10, 1951. Decl. with deletions Jan. 24, 1957. 31p. Contract W-7405-eng-36. $6.30(ph), $3.00(mf) OTS.

The total cross sections of the reactions DDp, DDn, TD at 10 kev to 10 Mev are estimated from a review of the experimental data up to January 1951. Maxwell averages for DDp and TD computed from these estimates are given, together with some fitted analytic expressions provided for machine use. A collection of the identifiable earlier estimates is also included for reference and for comparison with the new figures. For relative order of magnitude purposes, cross sections and the derived Maxwell averages are given down to 50 ev using the theoretical Gamow slopes for the extrapolation. Gamow plots for the derived cross sections above 10 kev are also given. Much of the primary experimental data exists in the form of thick target yields and we find the most uncertain factor in converting these thick targets yields into cross sections is the magnitude of the $D_2O$ stopping cross section. The particular $D_2O$ stopping cross section relation used in this derivation together with some of the earlier stopping cross sections are given. Thick target yields are included for both DD and TD on $D_2O$ targets, at 0.01 to 1 Mev, experimental values being supplemented by calculated values. (auth)

**11380** NDA-57-27

Nuclear Development Corp. of America, White Plains, N. Y.

POINT VALUE CROSS SECTIONS FOR THE MATERIALS H, $Li^6$, Be, B, C, F, Na, K, Cr, Fe, Ni, Zr, Gd, W, and Pb. C. W. Monroe, D. Pomeroy, and J. Ray. Sept. 1956. 72p. For Pratt and Whitney Aircraft Div. $15.30(ph), $5.40(mf) OTS.

Neutron cross sections for the reactor materials H, $Li^6$, $Be^9$, B, C, F, Na, K, Cr, Fe, Ni, Zr, Gd, W, and Pb are presented, accompanied by reference information and calculation methods. For each material the source of the total, absorption, and scattering cross sections are given. If cross sections were calculated (e.g., in the case of resonances), a calculation date, the method of calculation, constants used, and pertinent comments are listed. In most cases the scattering cross section was calculated by subtracting the absorption cross section from the total cross section, the equation being $\sigma_s = \sigma_t - \sigma_a$. Other equations used in the calculations are presented in the discussions of the individual elements. A table of "Energy and Lethargy" is presented at the end of the report. (auth)

**11381** TNCC(US)-30

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

THE STATUS OF CROSS SECTION MEASUREMENTS ON ISOTOPES IN THE THORIUM CYCLE. J. E. Evans. May 7, 1958. Includes attachment: THE TOTAL AND FISSION CROSS SECTIONS OF $U^{233}$ BELOW 1 KEV. R. G. Fluharty, M. S. Moore, and J. E. Evans. 18p. $3.30(ph), $2.40(mf) OTS.

Measurements were made of the fission and total cross sections of uranium-233. The major objectives in the resonance analysis of the cross section data are to describe the cross section so that values can be used for reactor calculations and to obtain physical constants which describe the nucleus. Graphical integrations of the quantity $\int_{0.4}^{\infty} \sigma\sqrt{E}\, dE$ were made for both the fission and the absorption cross sections as a means of determining resonance integrals. The fission integral obtained is 812 ± 30 barns, and the absorption integral is 927 ± 30 barns. The value of 1.14 obtained for the ratio is in good agreement with that of 1.15 quoted by Westcott. (A.C.)

**11382** TNCC(US)-32
Columbia Univ., New York.
PROGRAM OF MEASUREMENTS ON THE Pu ISOTOPES IN THE U. S. W. W. Havens, Jr., comp. [nd]. 10p. (CR-1778). \$1.80(ph), \$1.80(mf) OTS.

Resonance parameter data on Pu$^{240}$ and Pu$^{242}$ are given from three sites, Argonne National Laboratory, Oak Ridge National Laboratory, and Brookhaven National Laboratory. (A.C.)

**11383** TNCC(US)-36A
Knolls Atomic Power Lab., Schenectady, N. Y.
2200 m/sec CROSS SECTIONS OF U-235. Max L. Yeater. Oct. 25, 1957. 3p. \$1.80(ph), \$1.80(mf) OTS.

A review of thermal measurements of $\alpha$ and $\sigma_f$ for U$^{235}$ was made with particular emphasis on the possibility of new mass spectrometric analysis. Advances in mass spectrometry, amounting to about two orders of magnitude in sensitivity, suggest that what was done previously might be better and easier now. Use of a beam from a crystal spectrometer for sample irradiation is not yet feasible for mass spectrometry; however, pile irradiations can be used, with greater confidence now owing to removal of some restrictions on flux requirements and better pile instrumentation. A summary of some of the significant results is tabulated. (A.C.)

**11384** TNCC(US)-39
[Tripartite Nuclear Cross-Sections Committee.]
REPORTS BEARING ON U$^{235}$ THERMAL FISSION CROSS-SECTION DISCREPANCY. Mar. 1958. 27p. \$4.80(ph), \$2.70(mf) OTS.

Originally issued as LA-511 and LA-512.

The gamma-ray activity of two samples irradiated in the Clinton and Hanford piles and of the barium and cesium extracted from them was compared with the activities extracted from a sample in which the number of fissions was determined by monitoring during the neutron exposure. The results obtained show good internal consistency and indicate that $(8.9 \pm 0.3) \times 10^{17}$ and $(4.8 \pm 0.25) \times 10^{18}$ fissions, respectively, had occurred in the two samples. These results are compared with mass spectrometer data obtained by Williams and Yuster on the same samples to find the ratio of the capture and fission cross sections of U$^{235}$. (auth)

**11385**
RADIOACTIVE DECAY OF Au$^{200}$. J. C. Roy and L. P. Roy (Atomic Energy of Canada, Ltd., Chalk River, Ont.). Can. J. Phys. 37, 385-95(1959) Apr.

The half life of Au$^{200}$ was measured to be 48.4 ± 0.3 minutes. The beta radiations emitted in the decay of Au$^{200}$ were studied by absorption in aluminum, and the gamma radiations with a multichannel scintillation spectrometer. Two beta rays with end-point energies of 2.25 ± 0.20 and 0.7 ± 0.1 Mev and respective abundance of (75 ± 3)% and (25 ± 3)% were detected. Three gamma rays with energies of 0.367, 1.23, and 1.60 Mev were observed. It was established that the 0.367- and 1.23-Mev gamma rays are in coincidence. A decay scheme for Au$^{200}$ is proposed. (auth)

**11386**
MEASUREMENT OF THE ENERGIES OF NUCLEAR STATES EXCITED BY INELASTIC NEUTRON SCATTERING, AND A SEARCH FOR ELECTRIC MONOPOLE TRANSITIONS IN Pb. J. E. Evans, B. B. Kinsey, and B. G. Whitmore (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Can. J. Phys. 37, 396-412(1959) Apr.

A method of measuring the energies of nuclear states excited by inelastic neutron scattering is described, in which an energy-selective detector is used. The neutron source was Li or H$^3$ bombarded by protons from a Van de Graaff generator. The ratio of the counting rate produced in this detector by the material under study to that produced by a long counter was plotted against the proton energy. Peaks in this curve occur when the energy of the scattered neutrons is equal to the resonance energy of the selective detector (255 kev). The energies of the excited states responsible for these neutrons were determined with some precision by a step-by-step comparison with those produced by a standard material for which the energies of the excited states are already well known (e.g. Fe$^{56}$). A weak peak, not corresponding to any known state, was found in Zr. Two states in Fe$^{56}$ were used to determine the energies of peaks obtained from Pb. One of these was that due to the well-known state at 2.62 Mev. However, peaks were observed corresponding to both lower and higher energies, none of which agree with those of known excited states. Except for that caused by the 803-kev state of Pb$^{206}$, no other peaks were observed from a target of Pb$^{208}$. Th$^{232}$ produced strong peaks corresponding to excited states at 760 and 1080 kev; U$^{238}$ produced a peak at 710 kev and another (unresolved from higher energy peaks) at 940 kev. Both peaks near 700 kev from these two nuclei showed unresolved structure. A peak was found from natural Pb corresponding to an excited state at 3.185 Mev. Reasons are given for believing that this state is $0^+$. An unsuccessful search was made for annihilation radiation using coincident NaI crystals in a rectilinear arrangement. This apparatus detected readily the pair production from the $0^+$ state in Zr$^{90}$, but was apparently responsible for a spurious effect in Pb. If pairs are emitted by a 3.185-Mev state in Pb$^{208}$, the cross section for this process for neutrons with energy 0.5 Mev above threshold is probably less than one half of that from Zr$^{90}$ for an equal energy excess above threshold. (auth)

**11387**
MEASUREMENT OF THE PHASE SHIFTS IN (n,He$^4$) SCATTERING. Pierre Marin and Bang vo-Xuan. Compt. rend. 248, 1316-19(1959) Mar. 2. (In French)

The phase shifts $S_{1/2}$, $P_{1/2}$, and $P_{3/2}$ in (n,He$^4$) scattering were determined for six values of neutron energy between 6.4 and 6.9 Mev, by determining the helium recoil nuclei. The values of the phase shifts are in agreement with the theoretical calculations of Dodder and Gammel (Phys. Rev. 88, 520(1952)). (tr-auth)

**11388**
VIBRATION SPECTRUM OF THE Cd$^{114}$ NUCLEUS. Robert Arvieu. Compt. rend. 248, 1502-4(1959) Mar. 9. (In French)

The first excited level of Cd$^{114}$ possesses a probability of reduced transition to the fundamental state, revealing coöperative effects. At an excitation energy almost double the energy of the first level there is a triplet of levels with spins 0, 2, and 4 in which the properties are qualitatively in accord with the predictions of the collective quadrupole vibration model. However, the existence of another level above this triplet suggests the necessity of introducing other degrees of liberty than those which describe collective excitations. An examination is made to determine in what measure the coupling between these two modes of excitation permits a more complete description of the spectrum structure. The raising of degeneration of the collective triplet, the relative position of these levels with respect to the intrinsic origin level 2, and the transition probability deviations with respect to the predictions of the pure collective vibration model are considered in particular. (J.S.R.)

**11389**

(γ,p) REACTION IN Co. Miroslav Rozkoš (Charles Univ., Prague). Czechoslov. J. Phys. 7, 592-8(1957). (In Russian)

Measurements of the energy and angular distribution of photoprotons from cobalt irradiated by γ quanta in the Li(p,γ) reaction ($E_\gamma$ = 17.6 and 14.8 Mev) indicated that all protons are produced by evaporation. The temperature $\theta = 0.74 \pm 0.16$ Mev of $Fe^{58}$ and $E^*_\beta$ of excited energy levels 6.75, 6.44, 5.90, 5.47, 4.98, 4.35, 3.50, and 3.20 Mev were also measured. The angular distribution does not satisfy any known relation in photonuclear reactions. (tr-auth)

**11390**

YIELDS AND ANGULAR DISTRIBUTIONS OF PROTONS FROM $F^{19}(d,p)F^{20}$ AND $F^{19}(d,p)^{20}*$. Kazuo Ôno, Junji Shimada, Keiichi Kuroda, Osamu Tanaka, Hiromichi Kamitsubo, Atsuko Ito, Shigeya Tanaka, and Minoru Imaizumi (Univ. of Tokyo). J. Phys. Soc. Japan 14, 117-20(1959) Feb.

The reactions $F^{19}(d,p)F^{20}$ and $F^{19}(d,p)^{20}*$ were studied with deuteron bombarding energy of 1.3 to 2.0 Mev. Angular distributions of protons leaving $F^{20}$ in 0.65 Mev excited state show a pronounced peak at about 60° over the entire deuteron energy range. On the other hand, those leaving $F^{20}$ in the ground state vary with the deuteron bombarding energy and most of them show no peak in the forward direction and a large peak in the backward direction. The absolute yields of the reactions were measured at $\theta_{cm} = 54°$ and $\theta_{cm} = 104°$ as functions of the bombarding energy. A marked difference in the energy dependence of the yields for the two reactions is noted. The yield for the reaction $F^{19}(d,p)F^{20}$ at $\theta_{cm} = 104°$ shows a broad maximum centered at about 1.70 Mev deuteron energy, on the other hand that from the $F^{19}(d,p)F^{20}*$ reaction at $\theta_{cm} = 54°$ shows a slow increase with increasing deuteron energy. These results at our bombarding energies show that the reaction $F^{19}(d,p)F^{20}$ seems to proceed mostly by compound nucleus formation, and the reaction $F^{19}(d,p)F^{20}*$ (0.65 Mev) seems to be caused by the stripping process of d neutrons. (auth)

**11391**

ELASTIC AND INELASTIC SCATTERING OF 14.1-Mev PROTONS BY MEDIUM WEIGHT NUCLEI. Ken Kikuchi, Shinsaku Kobayashi, and Kazuhisa Matsuda (Univ. of Tokyo). J. Phys. Soc. Japan 14, 121-8(1959) Feb.

The absolute differential cross sections for the elastic scattering and the inelastic scattering (proceeding to the 1st excited state) of 14.1-Mev protons have been measured for Ni, Fe, Cr, and Ti with a five-degree (or less) interval ranging from 20 to 165 degrees. The scattered protons were detected by NaI (Tl) scintillation counter whose energy resolution was about 2.3%. Even at small angles the protons inelastically scattered could be discriminated from those elastically scattered. The angular distributions of inelastic protons agree to that expressed by $|j_2(qR)|^2$ which one would expect from the theoretical prediction based upon the Born approximation. (auth)

**11392**

NOTE ON THE SPIN OF EXCITED STATES OF CADMIUM 110. Mitsuo Sakai, Haruko Ohmura, and Teruo Momota (Univ. of Tokyo). J. Phys. Soc. Japan 14, 229 (1959) Feb.

The spin of $Ag^{110m}$ (253 days) was recently determined as 6 by the atomic beam magnetic resonance method. Since a previous analysis, concerning the angular correlation measurement of gamma rays from this nucleus, was based upon the assumption of 5 or 4 for the spin and parity of this level, it was considered worthwhile to reexamine the results. (W.D.M.)

**11393**

DETERMINATION OF THE HYPERFINE STRUCTURE SPLITTING OF THE SCANDIUM GROUND STATES $^2D_{3/2}$ AND $^2D_{5/2}$ AND THE QUADRUPOLE MOMENT OF THE $Sc^{45}$ NUCLEUS. G. Fricke, H. Kopfermann, S. Penselin, and K. Schlümann (Univ. of Heidelberg, Ger.). Naturwissenschaften 46, 106(1959). (In German)

The hyperfine structure of the ground states $^2D_{3/2}$ and $^2D_{5/2}$ of the $Sc^{45}$ I spectrum was investigated by the atomic beam resonance method. From the results the magnetic dipole and electrical quadrupole interaction constants were calculated as $a_{3/2} = 269.560 \pm 0.02$ MHz, $b_{3/2} = -26.37 \pm 0.1$ MHz, $a_{5/2} = 109.034 \pm 0.01$ MHz, and $b_{5/2} = -37.31 \pm 0.1$ MHz. The quadrupole moments obtained were $Q_{3/2} = -(0.2156 \pm 0.001) \times 10^{-24}$ cm$^2$ and $Q_{5/2} = -(0.2254 \pm 0.001) \times 10^{-24}$ cm$^2$. The quadrupole moment of the $Sc^{45}$ nucleus is $Q = (0.22 \pm 0.01) \times 10^{-24}$ cm$^2$. (J.S.R.)

**11394**

CALCULATED ACTIVITIES AND ABUNDANCES OF $U^{235}$ FISSION PRODUCTS. R. C. Bolles and N. E. Ballou (Naval Radiological Defense Lab., San Francisco). Nuclear Sci. and Eng. 5, 156-85(1959) Mar.

Computed disintegration rates and numbers of atoms (abundances) of each fission product radionuclide at various times after simultaneous slow neutron fission of 10,000 atoms of $U^{235}$ are presented. These results are based on fission yields from two different theories of independent fission yields. The computations treat both known and unknown fission product radionuclides. Half-lives and yields of the latter were estimated. The disintegration rate, number of active and inactive atoms, total number of atoms, and the percentage contribution to total activity and to the total number of atoms are presented for each element and for each chemical group of elements. The disintegration rate of the total fission product mixture according to each independent yield theory is also presented. (auth)

**11395**

GAMMA RADIATION FROM $^{63}Zn$. R. W. Hayward, E. Farrelly-Pessoa, and D. D. Hoppes (National Bureau of Standards, Washington, D. C.) and R. van Lieshout (National Research Council, Washington, D. C.). Nuovo cimento (10) 11, 153-5(1959) Jan. 16.

In the decay of 38 min $Zn^{63}$, γ rays are emitted with the following energies: 0.67, 0.96, 1.44, (2.0?), 2.35, 2.55, and 2.75 Mev. There is no 0.29 Mev transition. The 0.67 and 0.96 Mev γ rays are only strongly coincident with the annihilation radiation, not with each other. The results of the measurement are given. (auth)

**11396**

THE GAMMA RAY SPECTRUM OF $^{63}Zn$. R. A. Ricci, R. K. Girgis, and R. van Lieshout (Instituut voor kernphysich Onderzoek, Amsterdam). Nuovo cimento (10) 11, 156-66(1959) Jan. 16.

The γ spectrum from $Zn^{63}$ was measured by scintillation techniques, and a complete quantitative analysis was performed. The $\gamma$ rays found are reported with their relative intensities and compared with the levels found in $Cu^{63}$ by the recent inelastic proton scattering experiment reported by Mazari, Buechner, and de Figueiredo. The main features of the proposed partial decay scheme of $Zn^{63}$ are discussed. (auth)

**11397**

THE INTERNAL CONVERSION SPECTRA FROM THE DECAY OF $^{197}Hg^{m}$. I. J. van Heerden, D. Reitmann, and H. Schneider (National Physical Research Lab., C.S.I.R., Pretoria). Nuovo cimento (10) 11, 167-77 (1959) Jan. 16.

The relative intensities of a number of internal conversion lines in the decay of $Hg^{197}$ were determined rather accurately and compared with theoretical values. In general the agreement with static finite size corrected values is very good. It is found, however, that the theoretical M-shell coefficients are too large by about 40% in the cases studied. This is attributed to the neglect of the screening effect in the calculations. For the well-known 77.5 kev (M1 + E2) transition, the mixing ratio was found to be (9.4 ± 0.9)% E2, and the corrections which have to be applied to the point-nucleus coefficients for M1 conversion in the $L_1$ and $L_{11}$ shells are 0.75 ± 0.11 and $0.80^{+0.29}_{-0.24}$, respectively. These corrections are exactly those found if the static finite nuclear size effect is taken into account, and therefore indicate the absence of any structure dependent (dynamic) effect in this case. (auth)

**11398**

THE RANGE-ENERGY RATIO FOR $Li^7$, $Be^9$, AND $B^{11}$ IN THE EMULSION. V. N. Maikov (Inst. of Physics, Academy of Sciences, U.S.S.R.). Pribory i Tekh. Ekspt. No. 1, 50-3(1959) Jan.-Feb. (In Russian)

The range-energy relation for $Li^7$, $Be^9$, and $B^{11}$ nuclei was derived for ($\gamma$,p$\alpha$) reactions with carbon, nitrogen, and oxygen emulsions. The results are compared with the experimental and theoretical data. (tr-auth)

**11399**

ON THE THEORY OF NUCLEAR SCATTERING OF SLOW NEUTRONS IN ALLOYS. V. M. Danilenko and Z. A. Matysina (Inst. of Metal Physics, Academy of Sciences, Ukrainian S.S.R.). Ukrain. Fiz. Zhur. 3, 743-50(1958) Nov.-Dec. (In Ukrainian)

A formula was derived for the probability of neutron scattering due to concentration heterogeneities for binary and ternary alloys with hexagonal crystal lattices of the AB and $AB_3$ types. Both the long order and the correlation in the replacement of lattice points by various kinds of atoms are taken into consideration. (auth)

**11400**

EXCHANGE OF CHARGE BETWEEN CESIUM IONS AND ATOMS. R. M. Kushnir (Frank L'vov State Univ.). Ukrain. Fiz. Zhur. 3, 788-95(1958) Nov.-Dec. (In Ukrainian)

Measurements were made of cross sections of the charge exchange between cesium ions and atoms in the ion energy interval 6 to 656 ev by the detaining field method and the method of exhaustion of slow ions. To eliminate the influence of secondary electron emission from the electrodes on the results of the measurements, a weak (H ~ 30 gauss) magnetic field was applied perpendicular to the ion beam. The same method was used to measure the sections of charge exchange between potassium ions and atoms. A comparison of the results obtained with theoretical values shows that the given results agree best with the theoretical data of O. B. Firsov. The experimental values of the sections of charge exchange for cesium are greater than the corresponding values obtained for potassium, which agrees with theory. (auth)

**11401**

ANGULAR DISTRIBUTIONS OF 2.8 Mev NEUTRONS ELASTICALLY SCATTERED BY LIGHT NUCLEUS ELEMENTS. V. V. Bobir, V. I. Strizhak, and I. A. Tots'kii (Inst. of Physics, Academy of Sciences, Ukrainian S.S.R.). Ukrain. Fiz. Zhur. 3, 836-7(1958) Nov.-Dec. (In Ukrainian)

Measurements were made of the angular distributions of 2.8-Mev neutrons elastically scattered by aluminum, magnesium, and sulfur. The neutron source was obtained from the D(d,n)$He^3$ reaction. Neutrons were recorded with a circular ionization chamber filled with methane up to 11 atm. Measurements were made at 25 to 150° angles. The results are given in graphs. (R.V.J.)

**11402**

GAMMA-IZLUCHENIYE RADIOAKTIVNYKH IZOTOPOV I PRODUKTOV DELENIYA; TEORIYA I TABLITSY. (Gamma-Radiation of Radioactive Isotopes and Fission Products; Theory and Tables.) Nikolay Grigor'yevich, Vadim Pavlovich Mashkovich, and Gennadii Vasil'yevich Obvintsev. Moscow, Fizmatgiz, 1958. 208p.

Data on gamma radiation from radioactive isotopes and from mixtures of $U^{235}$ fission products are given. Gamma constants are given for about 400 isotopes. Other characteristics given are: gamma activity per 1 mc in mg-equiv. of radium, intensity of bremsstrahlung, specific $\beta$ and $\gamma$ activities, and the spectral distribution of $\gamma$ radiation from $U^{235}$ fission products. (TCO-W.D.M.)

## Theory

**11403** NP-7348

Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Theoretical Physics.

ON THE PRINCIPLE OF COMPENSATION AND METHOD OF THE SELF-CONSISTENT FIELD. N. N. Bogoliubov (Bogolubov). 1959. 39p.

The principle of compensation of the "dangerous" graphs in the general spatially inhomogeneous case is considered. It is shown that the equations of the first approximation coincide with those of the generalized method of the self-consistent field. The obtained results are used for investigation of collective oscillations, the problem of the gage invariance, and the Meissner effect in the theory of superconductivity. (auth)

**11404** NP-tr-229

ON A VARIATIONAL PRINCIPLE IN THE MANY BODY PROBLEM. N. N. Bogolyubov (Bogolubov) and V. G. Solov'ev (Soloviev). Translated from Doklady Akad. Nauk S.S.S.R. 124, 1011-14(1959). 5p. $1.80(ph), $1.80(mf) JCL or LC.

A further study was made of the variational principle in the many-body problem. An explicit steady-state form of equation was derived and the variant applied in two specific cases. (R.V.J.)

**11405**

THE ELECTRON OF THE UNIVERSAL FERMI INTERACTION. Luis M. Garrido Arilla and P. Pascual de Sans (Junta de Energia Nuclear, Madrid). Anales real soc. españ. fís. y quím. (Madrid), Ser. A 55A, 5-12(1959) Jan.-Feb. (In Spanish)

The canonical formulation for the two-component electron theory proposed by Feynman (Phys. Rev. 109, 193(1958)) is presented. It probably describes correctly the electron of the universal Fermi interaction. (auth)

**11406**
THE CHIRALITY INVARIANCE OF $\pi$ MESON-NUCLEON INTERACTIONS. Kuo-Hsien Tzou. Compt. rend. 248, 1300-3(1959) Mar. 2. (In French)

It is shown that the chirality invariance of fermions and the charge independence leads to the conservation of parity and to the identity of the helicity of the neutron and proton in $\pi$ meson-nucleon interactions. (tr-auth)

**11407**
THERMODYNAMIC FOUNDATION OF THE THEORY OF PLASMA. Taro Kihara (Univ. of Tokyo). J. Phys. Soc. Japan 14, 128-33(1959) Feb.

Thermodynamics of irreversible processes is applied to dense plasmas in a weak magnetic field. Basic equations of "magneto-thermo-hydrodynamics" are derived together with relations between transport coefficients. Extremely dilute plasmas and plasmas at the Debye-Hückel limit are discussed as particular cases. (auth)

**11408**
THE MONTE CARLO METHOD. W. F. Bauer (Ramo-Wooldridge Corp., Los Angeles). J. Soc. Ind. Appl. Math. 6, 438-51(1958) Dec.

A description of the many facets of the Monte Carlo Method is presented. The subject is traversed from the most elementary to the more difficult techniques, and from the least practical to the most fruitful applications. The generation of random numbers in the modern electronic computing machine is dealt with. Most of the material is of an expository nature, but the section on the solution of elliptic partial differential equations with certain boundary conditions is new. Some general remarks on evaluating the method are given. (W.D.M.)

**11409**
APPROXIMATE SOLUTIONS OF TRANSPORT PROBLEMS. PART I. STEADY-STATE, ELASTIC SCATTERING IN PLANE AND SPHERICAL GEOMETRY. Herbert B. Keller (New York Univ.). J. Soc. Ind. Appl. Math. 6, 452-65(1958) Dec.

A method for the approximate solution of some transport problems is presented. The procedure is applied and an approximate solution obtained for the steady-state, elastic scattering of neutrons in an infinite plane slab of finite thickness and arbitrary composition. The convergence of the approximate solution to the exact solution in the appropriate limit is demonstrated. It is shown that the approximate solution is stable with respect to the growth of small errors introduced by approximating the inhomogeneous source terms. (W.D.M.)

**11410**
BOSE-EINSTEIN STATISTICS AND HELIUM FILMS. A. D. Singh and R. K. Pathria (Univ. of Delhi). Nature 183, 668(1959) Mar. 7.

Following a proposal that the peculiar transition in liquid helium may be due to the accumulation of a significant fraction of the total number of particles in the ground state of a Bose-Einstein gaseous assembly, many attempts have been made to understand the behavior of this liquid in terms of the quantum statistics of a Bose gas. Since it is to be expected that the properties of a statistical assembly would be modified when at least one of its dimensions becomes comparable with the mean de Broglie wavelength of the particles, it is believed that a proper analysis based upon the Bose-Einstein statistics should be able to explain the observed phenomenon. In this discussion it is shown that such a study is possible provided the eigenfunctions in the bounded continuum are enumerated more exactly than is ordinarily done. (J.H.M.)

**11411**
ON THE RENORMALIZATION OF THE AXIAL VECTOR $\beta$-DECAY COUPLING. K. Symanzik (Max-Planck-Institut für Physik, Munich). Nuovo cimento (10) 11, 269-77(1959) Jan. 16.

A formula expressing the ratio $g_A/g_V$ in $\beta$ decay on the basis of equality of the corresponding bare coupling constants is proposed and proved in perturbation theory with cut-off, provided electromagnetic interactions are neglected. The physical background of a formula of this type is discussed and illustrated by comparison with recent work by Goldberger and Treiman on $\pi$-$\mu$ decay. (auth)

**11412**
PRELIMINARY REMARKS ON A CONSEQUENCE OF THE ISOBAR MODEL OF MULTIPLE MESON PRODUCTION. H. W. Meier (Deutsche Akademie der Wissenschaften, Berlin). Nuovo cimento (10) 11, 307-10(1959) Jan. 16.

In previous investigations of multiple meson production in high-energy N-N collisions, the Lorentz factor $\gamma_c$ was determined with the assumption that the emitting centers move parallel in the L-system, $\gamma_c = \gamma,\gamma_2$, and from the energy conservation low of the isobar model, $\gamma_c = \sqrt{{}^1/_2(\gamma_1 + \gamma_2)\ [1 + {}^3/_4\ (\overline{E}''/mc^2)n]}$. Numerical values of $\gamma_c$ computed by the two methods are not in agreement. Data from two cosmic jets were treated using Lorentz transformations without the assumption that the emitting centers move parallel. Values for $\gamma_1$, $\gamma_2$, $\gamma_c$, and the angles between emitting centers are tabulated. (D.E.B.)

**11413**
ON THE APPLICATION OF THE METHOD OF RIESZ IN QUANTUM FIELD THEORY. Ye. I. Filippovich. Ukrain. Mat. Zhur. 10, 223-8(1958).

For the treatment of the diverging integrals of quantum theory a method is proposed which combines the method of Riesz with the set-ups of Hadamard. (W.D.M.)

**11414**
CONTEMPORARY STATE OF THE $\beta$ DECAY THEORY. Ya. Smorodinskii. Uspekhi Fiz. Nauk 67, 43-98(1959) Jan. (In Russian)

The problems of nonconservation of parity in $\mu$- and K-meson decay and the universal weak interactions are discussed. The review is limited to the subjects related to $\beta$ decay. 150 references. (R.V.J.)

**11415**
PRINCIPLES OF QUANTUM ELECTRODYNAMICS. Walter E. Thirring. Translation of "Einführung in die Quantenelektrodynamik." New York, Academic Press Inc., 1958. 245p.

One of the best understood parts of quantum field theory, quantum electrodynamics, is considered. An attempt is made to emphasize the physical basis of the theory and to avoid purely mathematical details. For this reason, the book should not be taken as a handbook of field theory, but rather as a compendium of the most characteristic and interesting results which have been obtained up to now. A background of analysis and linear algebra in mathematics and special relativity and quantum mechanics in physics is assumed in the reader. (W.D.M.)

## RADIATION EFFECTS ON MATERIALS

**11416** AECU-4051
Stanford Research Inst., Menlo Park, Calif.
RADIATION STABILITY OF ORGANIC LIQUIDS. Semi-Annual Report No. 1 [for] January 1 to June 30, 1957. R. M. Wagner, E. M. Kinderman, and L. Towle. Sept. 3, 1957. 16p. SRI Project No. SD-2080-1. For Oak Ridge National Lab. Contract W-7405-eng-26, Subcontract 1081. $3.30(ph), $2.40(mf) OTS.

Preliminary studies were completed on the nature and amount of the radiolysis products of tributyl phosphate, hydrocarbon diluent, dibutyl phenylphosphonate, and mixtures of these or combined with aromatic diluents. Analysis showed the presence of many substances, and the yields of acidic components identified generally agree with those determined by other workers. High boiling components produced by the radiolysis of tributyl phosphate were isolated but are not yet identified. Organic synthesis produced dibutyl phenyl phosphonate and tetrabutyl desoxyphenyl triphosphate. Preliminary examination of the first of these compounds indicated that it is six times as resistant to radiolytic decomposition as tributyl phosphate. Studies by Baldwin indicate the uranium extraction ability of this compound to be 25% better than that of tributyl phosphate, using 0.6M $HNO_3$ feed. Emulsification studies, using irradiated tributyl phosphate-hydrocarbon diluent mixtures, indicated that, at sufficiently high doses, species contributing to emulsion phenomena originate from both extractant and diluent. Fabrication of a spinner column is about 80% completed, and calibration is scheduled for late July. (auth)

**11417** AECU-4052
Stanford Research Inst., Menlo Park, Calif.
RADIATION STABILITY OF ORGANIC LIQUIDS. Semi-Annual Report No. 2 [for] July 1 to December 31, 1957. R. M. Wagner. Jan. 14, 1958. 29p. SRI Project No. SD-2080-1. For Oak Ridge National Lab. Contract W-7405-eng-26, Subcontract 1081. $4.80(ph), $2.70(mf) OTS.

Preliminary studies were completed on the nature and amount of the radiolysis products of dibutyl butanephosphonate, 50% dibutyl butanephosphonate-50% Amsco 125-82 mixture, diamyl pentanephosphonate, 50% diamyl pentanephosphonate-50% Amsco 125-82 mixture, high level dose TBP, and dibutyl phosphoric acid. Results of analysis indicated that aliphatic phosphonates are superior to aliphatic phosphates, but inferior to aromatic-aliphatic phosphonates in resistance to radiolytic degradation. Radiolysis data indicated that the phenyl group of phosphonates inhibited gas production when irradiated alone or in Amsco solution, however the phenyl protective effect did not apply to acid production. Aliphatic phosphonates yielded lower G(acid) values than did phenyl phosphonates. No large differences were observed in nature or yield of radiolysis products from the phosphonates. Comparison of radiolysis data of tributyl phosphate with that of aliphatic phosphonates, however, indicates reductions in G(gas) and G(acid) values of factors of 2 and 15, respectively due to the radiolytic stability of the phosphonate structure. Emulsification studies, comparing irradiated TBP and phosphonates, indicated no marked differences between the systems studied. The interpretation of results was complicated by the prevalence of three-phase phenomena due to the high dose levels employed. Tributyl phosphate, irradiated to 1900 whr/liter levels, was studied from the aspects of methods suitable for removal of radiolysis products, methods suitable for isolation of polymeric species, and identification of polymer constituents. Treatment of 1900 whr/liter TBP, diluted with Amsco 125-82 and virgin TBP, with a mixture of sodium and ammonium hydroxides was found to be more effective than simple caustic strip for restoring irradiated TBP to recycle condition. The effectiveness of the treatment was determined by measuring uranium distribution ratios using both spinner column and separatory funnel studies. Duolite A-2 anion exchange resin was used to remove acidic radiolysis products from 1900 whr/liter TBP prior to isolation of polymeric species by vacuum distillation. A G value of 0.91 for polymer was obtained. Cryoscopic studies with the polymer indicated a gross molecular weight of 840 to 850. G values for gas and polymer of 3.40 and 1.42 were obtained from irradiation of dibutyl phosphoric acid to 1280 whr/liter levels. These values are slightly higher than the corresponding values for tributyl phosphate. The solubility of thorium dibutyl phosphate in Amsco 125-82 was determined to be 0.1 g/liter at 26°C. Diethyl carbonate was evaluated as an extractant for uranium by separatory funnel and spinner column studies. The extraction is highly acid dependent and is sensitive to salt effects. Using 0.2M uranyl nitrate of both 6M and 8M nitric acid strengths as feeds at organic/aqueous ratios of 1:2, uranium separation factors of 0.45 and 0.82 were obtained. TBP-Amsco systems yield separation factors pf 5 under 2M nitric acid conditions. (For preceding period see AECU-4051.) (auth)

**11418** AECU-4053
Stanford Research Inst., Menlo Park, Calif.
RADIATION STABILITY OF ORGANIC LIQUIDS. Semi-Annual Report No. 3 [for] January 1 to June 30, 1958. R. M. Wagner and L. H. Towle. June 30, 1958. 41p. SRI Project No. SD-2080-1. For Oak Ridge National Lab. Contract W-7405-eng-26, Subcontract 1081. $6.30 (ph), $3.00(mf) OTS.

Preliminary studies were completed on the nature and amount of the radiolysis products of tributyl phosphate containing equilibration quantities of 2M aqueous $HNO_3$, a 1:2 volume ratio two-phase TBP-2M aqueous $HNO_3$ system, a 5% TBP-95% Amsco-2M $HNO_3$ two-phase system, four different (15-30-45-60%) TBP-Amsco phases containing equilibration quantities of 2M $HNO_3$, didecyl decanephosphonate, diethyl carbonate, diethyl carbonate containing equilibration quantities of 1M $HNO_3$, di-(2-ethylhexyl) phosphoric acid, tri-n-octyl phosphine oxide, and tri-iso-octyl amine. The effect of nitric acid on tributyl phosphate radiolysis was tested in a variety of situations. G(MBP) values obtained from the two TBP-$HNO_3$ studies indicated that 2M $HNO_3$ resent either in an acid-saturated single phase, or as a second phase, increased the G(MBP) value by a factor of four. Amsco solutions of TBP in the presence of $HNO_3$ did not differ in G(MBP) yield from pure TBP irradiations. Acid-saturated TBP produced G(gas) values twice that of pure TBP. Amsco solutions of TBP, equilibrated with

2M $HNO_3$ prior to irradiation, produced G(gas) values roughly one-half of the value for pure TBP. Studies of new alternate solvents for TBP were extended to include a detailed study of diethyl carbonate for process application. Diethyl carbonate, when saturated by equilibration with 2M $HNO_3$, yielded G(gas) values 20% higher than pure diethyl carbonate. G(acid) levels were 1% of those found for irradiated TBP. Irradiations of didecyl decanephosphonate and tri-n-octyl phosphine oxide indicated that the two compounds had comparable G(gas) values, but the phosphine oxide produced G(acid) values three to four factors smaller. Irradiation of a commercial tri-iso-octyl amine to 1795 whr/liter dose level produced a gross target destruction by radiolysis of almost 60%. Irradiation of pure tributyl phosphate to the same dose results in about 35% destruction. Irradiation of di-(2-ethylhexyl) phosphoric acid produced a G(dibasic acid) value roughly one-third of that from DBP. However, the G(phosphoric acid) value for the compound exceeded that of DBP by a factor of six. The $-G_M$(polymer) value was one-third that of DBP and one-half that of TBP. The $-G_M$(target) value was 50% higher than the value for TBP and 20% lower than that for DBP. Studies of factors causing poor process performance were made by evaluation of U retention and emulsification. Spinner column studies indicated that 65% of the U retention of irradiated TBP was due to DBP and only 20% due to radiation polymer. Irradiation of $HNO_3$-saturated TBP-Amsco systems increased the U retention, compared to that of unirradiated systems, by factors of three to four at 400 whr/liter levels. Emulsification studies indicated that radiation polymer is the main contributor to emulsification phenomena with irradiated TBP at dose levels from 25-100 whr/liter. Degree of emulsification was increased by factors of three to four when $HNO_3$-saturated TBP-Amsco systems were irradiated to 400 whr/liter. Several properties of diethyl carbonate of process interest were studied. Separatory funnel studies indicated diethyl carbonate to be 50% as efficient as 25% TBP-Amsco systems for extraction of U from acidic 2M $Al(NO_3)_3$ aqueous systems. The U retention of $HNO_3$-saturated diethyl carbonate, after irradiation to 380 whr/liter dose, was higher than that observed with pure irradiated diethyl carbonate at 980 whr/liter levels by a factor of two. This higher level of retention, however, is equal to that of unirradiated 25% tributyl phosphate-Amsco systems. Diethyl carbonate was evaluated as an extractant for Th from aqueous 0.2M $Th(NO_3)_4$$-$2M $Al(NO_3)_3$ solutions of varying $HNO_3$ content (0 to 4M). The solubility of diethyl carbonate in 2M Al aqueous acidic systems was 1-2 g/liter as measured by quantitative infrared spectrometry. The solubility of thorium dibutyl phosphate in TBP-Amsco mixtures was found to be no more than 0.04 g/liter and probably much less than this level. (For preceding period see AECU-4052.) (auth)

**11419** AECU-4054
Stanford Research Inst., Menlo Park, Calif.
RADIATION STABILITY OF ORGANIC LIQUIDS. Semi-Annual Report No. 4 [for] July 1 to December 31, 1958. R. M. Wagner and L. H. Towle. Jan. 5, 1959. 47p. SRI Project No. SD-2080-1. For Oak Ridge National Lab. Contract W-7405-eng-26, Subcontract 1081. \$7.80(ph), \$3.30(mf) OTS.

Eight solutions of TBP in Amsco, varying in wt. % TBP from 0 to 100 were irradiated with electrons to 300 to 400 whr/liter. The G(total acid) values obtained indicated that, from 0 to 60 wt. % TBP, the acid production rate is proportional to wt. % TBP; above 60 wt. % TBP the acid production rate is lower. Normalized total acid G values, obtained by partition of the dose on a basis of wt. % TBP, ranged from 2.31 to 3.52. Seven TBP-Amsco solutions, ranging from 5 to 60 wt. % TBP, and samples of pure TBP and pure dibutyl phenylphosphonate (DBPP) were irradiated to 400 whr/liter. Five compositions of TBP, DBPP, Amsco, and tetralin were irradiated to 200 whr/liter. The amount of radiation-induced unsaturation was measured for each of the above samples. The data indicated that unsaturation varied inversely with wt. % TBP. The DBPP exerted a small protective effect, as did tetralin, in reducing radiation damage to the Amsco. Diethyl carbonate, irradiated to 392 whr/liter, had a G(gas) value of 4.86, a $-G_M$(target destruction) value of 5.50, and a $-G_M$(polymer) value of 2.80. Diethyl carbonate, after irradiation, extracts U better than virgin material and strips equally as well. The irradiated diethyl carbonate exhibited no difference from virgin material in emulsification tendency. Dibutyl phenylphosphonate-Amsco systems, at dose levels of either 200 or 400 whr/liter, showed that acid production is about proportional to wt. % DBPP. Studies of DBPP-Amsco-tetralin systems at 200 whr/liter indicated that tetralin is more acceptable than decalin for enhancing the solubility of the DBPP-uranium complex in Amsco, thus suppressing third-phase phenomena. Tetralin also reduced acid production from DBPP under irradiation. Tributyl phosphate, dibutyl phosphoric acid, and di-(2-ethylhexyl) phosphoric acid were irradiated in the pure state to 300 whr/liter. The G(gas) values were 1.9, 3.3, and 3.1, respectively, and the G(total acid) values were 2.3, 2.1, and 1.2. The $-G_M$ values for target converted to polymer were 0.22 for the DBP, and 0.32 for the D2EHP. Tri-n-octyl phosphine oxide was irradiated in the pure state to 400 whr/liter. The G(gas) value of 1.82 was comparable to a value of 1.45 found previously at 2040 whr/liter. Values of $-G_M$ for target and polymer were approximately double the values previously found at 2040 whr/liter. Amines, including tri-lauryl amine, n-benzyl heptadecyl amine, tri-iso-octyl amine, Primene JM-T, and tri-octyl-decyl-t-amine (Alamine) were irradiated to either 200- or 400-whr/liter doses. The Primene produced the lowest $-G_M$(polymer) value, (1.50) and the Alamine produced the highest $-G_M$(total target destroyed) value (3.49). An Alamine-tridecanol-Amsco-nitric acid system yielded the lowest G(gas) value (1.89) while the corresponding tri-lauryl amine system produced the highest (3.12). The most extensive emulsification occurred with the 0.5M tri-lauryl amine-Amsco-tridecanol system while the n-benzyl heptadecyl amine system exhibited the lowest emulsification tendency. The most efficient U extractant system observed was the Alamine-Amsco-tridecanol-nitric acid composition, at the 0.5M-Alamine level. A comparison was made of the quantity and composition of material removed from irradiated TBP-Amsco by various scrubbing media. A single scrub with 2M NaOH appears four times more efficient than does a single scrub with saturated CaOH in removing acidic radiolysis products. The emulsification tendency of the scrubbed organic appears to increase with the quantity of acidic radiolysis products removed. Radiolysis products other than those of acidic nature (polymer) are apparently not removed by the scrubbing media investigated in this study. An irradiated TBP-Amsco phase (400 whr-liter) was contacted with U feed and then scrubbed with 1M $Na_2CO_3$

and passed through an activated alumina column. The resulting organic phase possessed an emulsion tendency equal to that of virgin tributyl phosphate-Amsco, and performed similarly to virgin TBP-Amsco in U extraction and stripping operations. This procedure appears to be the most efficient method of cleanup examined during this investigation. In a further test of this treatment, two samples of 30% TBP-70% Amsco (wt. %) were contacted once with 2M $HNO_3$-0.2M UNH aqueous feed, and the resulting organic phases were irradiated to 50- and 400-whr/liter doses. These irradiated phases were treated with 1M $Na_2CO_3$ and/or passed through an activated alumina column. U extraction and stripping studies on the organic effluent from these two processes indicated that the alumina treatment did not remove U retentive species which the previous carbonate wash had not removed. The alumina did remove emulsifiers, however, which the carbonate did not. (For preceding period see AECU-4053.) (auth)

**11420** AECU-4055

Sanderson and Porter, New York.

THE PEBBLE BED REACTOR PROGRAM. Summary of the First Capsule Irradiation. Jan. 14, 1959. 8p. Contract AT(30-1)-2207. (S & P 1963A-8). $1.80(ph), $1.80(mf) OTS.

Various types of uranium—graphite fuel elements were irradiated in the central hole of a 1-Mw swimming pool reactor at a flux of $4 \times 10^{14}$ n/cm$^2$-sec. The impregnated graphite sphere samples were prepared with an aqueous uranyl nitrate solution with subsequent baking for conversion to $UO_2$. Other types included an admixture of high fired $UO_2$ blended with graphite powder and coal tar binder and lumped specimens prepared by mixing a phenolic coke filler with $UO_2$ and a phenolic binder. Test results such as dimension and weight change are listed as well as results of compression tests, impact tests, and abrasion tests. Also, fission product leakage to the inner capsule gas space was collected and measured. (J.R.D.)

**11421** AERE-M/M-219

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

PART I. THE POSSIBLE EFFECTS OF IRRADIATION IN A NUCLEAR REACTOR ON THE PROPERTIES OF STEEL. S. F. Pugh. PART II. A PROGRAMME FOR INVESTIGATING NEUTRON IRRADIATION EFFECTS IN IRON AND STEELS. D. R. Harries and C. Judge. Jan. 1959. 31p.

The basic phenomena and ideas relevant to the subject of radiation damage, particularly to the effects of fast and thermal neutrons on the brittle fracture characteristics of mild steel, are reviewed in Part I. In Part II the investigations being carried out on the effects of neutron irradiation on the properties of steels are discussed. (L.T.W.)

**11422** IDO-16490

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

CHEMICAL DOSIMETRY AT THE MTR. S. D. Reeder, J. A. Dunbar, and N. P. Alley. Dec. 15, 1958. 36p. $1.00(OTS).

This report contains reference material concerning the concept of dose with respect to aqueous systems, a brief introduction to the theory of chemical dosimeters as outlined by the proposed reactions for the ferrous system, and a discussion of the limiting features of the ceric and ferrous sulfate systems used. The chemical dosimetry procedures are outlined and information obtained in their use is discussed. A new concept of "electrometric chemical dosimetry" is reported which eliminates the need for analysis of dosimeter solutions after irradiation. By means of a bimetallic electrode system the time required for complete consumption of the dosimeter solution is measured as a factor in determining the gamma flux. (auth)

**11423** IGR-TN/W-1046

United Kingdom Atomic Energy Authority. Industrial Group. Windscale Works, Sellafield, Cumb., England.

THE ESCAPE OF KRYPTON FROM IRRADIATED URANIUM ON HEATING. J. F. Walker. 1959. 16p.

The escape of fission-product krypton from irradiated uranium was studied by heating specimens in vacuo and analyzing the evolved gas by beta counting. Diffusion coefficients were measured over the range 300 to 900°C. The release rates did not follow those predicted by the theory of diffusion. Grain-boundary diffusion is believed to be responsible for this lack of agreement and also for the large variations in release rate between different specimens at the same temperature. Above 900°C, swelling and cracking of the specimens released the gas rapidly; a diffusion process no longer operated. Several experiments were made to find whether the trapping of gas by bubbles reduced the effective diffusion coefficients. However, no reductions in the release rates were found in experiments with specimens known to contain gas bubbles. (auth)

**11424** NAA-SR-Memo-1099

North American Aviation, Inc., [Downey, Calif.].

AN EXPERIMENT TO DETERMINE THE RADIATION STABILITY OF BORON TRIFLUORIDE AND ITS CORROSION OF VARIOUS METALS UNDER NEUTRON IRRADIATION. Warren K. McCarty. Sept. 17, 1954. Decl. Nov. 6, 1958. 12p. $3.30(ph), $2.40(mf) OTS.

A reactor control device currently being studied incorporates boron trifluoride as a reactor poison. It is subjected to high intensity neutron and gamma flux for extended periods of time. The extent of radiolysis of $BF_3$ and the extent of the chemical reaction of the containing materials with $BF_3$ and with radiolysis products were determined. (auth)

**11425** NAA-SR-Memo-1246

North American Aviation, Inc., [Downey, Calif.].

RECENT EXPERIMENTS REGARDING RADIATION DAMAGE IN GRAPHITE AND SUGGESTED FUTURE EXPERIMENTS. J. Krumhansl. Jan. 27, 1955. Decl. Nov. 6, 1958. 12p. $3.30(ph), $2.40(mf) OTS.

Some data on low-temperature radiation damage to graphite are presented. It is pointed out that only by exploiting low-temperature measurements can the real history of damage be understood. The damage is considered in three phases, including initial developed and annealing phase damage. In addition, a summary of experiments proposed for achieving the objective of a damage model are presented. (J.R.D.)

**11426** NM-008-015.04.01

Naval Medical Research Inst., Bethesda, Md.

THE STUDY OF INDUCED RADIATION IN DENTAL MATERIALS. G. W. Imirie. Mar. 3, 1954. 8p.

Eighty-one samples of various materials commonly used in dental work were exposed to the radiation of an atomic detonation. These samples, while being distant enough to suffer no physical or thermal damage, received $10^{11}$ neutrons per square centimeter. Certain specific elements of these materials became dangerously radioactive. Notably, these were cobalt, tantalum, silver, chromium, phosphorus, and gold. A qualitative, and in some cases a semi-quantitative, evaluation of the degree of induced radioactivity is given. (auth)

**11427** NP-7357(Pts. I and II)
International Business Machines Corp. Military Products Div., Owego, N. Y.
SOME EFFECTS OF PULSED NEUTRON RADIATION ON ELECTRICAL COMPONENTS. [PART I]. (Derived from Appendix R of the Third Semiannual Engineering Report of the AN/ASQ-28(V).) 66p. PART II. 43p. Contract AF33(600)-31315.

These two parts were issued separately, but are cataloged as a unit.

Experiments were performed to determine the effects of the pulsed radiation from the Godiva critical assembly on various general purpose electronic components. Transient current and/or voltage changes, similar in shape to the Godiva pulse, were observed in transistors, diodes, Zener diodes, capacitors, resistors, and vacuum tubes. Magnitudes of these changes are presented in the body of the report. Permanent damage as a result of exposure to Godiva radiation was observed in the gain of transistors and in the forward characteristics of one type of diode. (auth)

**11428** NP-7360
Battelle Memorial Inst. Radiation Effects Information Center, Columbus, Ohio.
MONTHLY ACCESSION LIST 21 [ON RADIATION EFFECTS DATA]. Mar. 15, 1959. 27p.

**11429** NP-7371
Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
AN ANALYSIS OF THE REQUIREMENTS FOR LARGE-VOLUME, HIGH-INTENSITY, GAMMA ENVIRONMENTAL TESTING FACILITIES (thesis). Robert T. Carpenter and David M. Ericson, Jr. Mar. 1959. 132p.

The many factors which have an influence on the requirements of a Gamma Environmental Testing Facility (GETF) and which must be considered prior to and during the planning and design phases are analyzed. The relationships of the various parameters of radiation effects testing are discussed. To determine the feasibility of simulating these gamma environmental requirements, an evaluation of various types of gamma radiation sources is included. (W.D.M.)

**11430** WAPD-P-264
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
CORRELATION OF RADIATION DAMAGE WITH FAST FLUX DISTRIBUTION IN THE MTR. W. F. Witzig and M. L. Bleiberg. Dec. 8, 1952. Decl. April 13, 1959. 7p. $1.80(ph), $1.80(mf) OTS.

It is possible to obtain the functional dependence of electrical resistivity upon integrated flux in a single MTR experiment. To obtain a correlation, a fast flux monitor should be included in each capsule. The change in electrical resistivity of Zr is seen to increase rapidly with integrated flux until the value $3 \times 10^{19}$ n/cm$^2$ is reached. Beyond this exposure to $6 \times 10^{19}$ the change in resistivity is small. With the use of sufficient flux monitors it should be possible to accurately determine the rate of radiation damage with exposure. (W.L.H.)

**11431** CEA-tr-R-593
DETERIORATION DES SCINTILLATEURS EN MATIERE PLASTIQUE PAR LES RAYONNEMENTS IONISANTS. II. (Deterioration of Scintillators in Plastic Material by Ionizing Radiations. II.) I. M. Rozman (Rozmane). Translated into French from Izvest. Akad. Nauk S.S.S.R., Ser. Fiz. 22, 60-6(1958). 17p.

The kinetics of deterioration of scintillators in polystyrene with additions of 1,1,4,4-tetraphenylbutadiene (TFB) and of terphenyl (pT) + TFB was studied using Po$^{210}$ alphas and Ce$^{144}$ – Pr$^{144}$ $\beta$ rays. For all samples a decrease in luminescence intensity with increase in dose was observed. Also, a yellowing of the samples was observed. (T.R.H.)

**11432**
EMPLOYMENT OF NEUTRON IRRADIATION IN STUDYING MARTENSITE TRANSFORMATIONS. A. I. Zakharov and O. P. Maksimova. Sbornik Trudov Inst. Metalloved. i Fiz. Metal. Tsentral. 5, 124-35(1958). (Translation from Referat. Zhur. Met. No. 8, 1958, p. 211.)

The effect of neutron irradiation (NI) on martensite transformation (T) was investigated on five types of steel containing respectively: 0.48% C, 7.7% Mn, 2.2% Cu (steel 50G8); 1.4% C. 4.0% Mn (steel 140G4); 0.50% C, 21.0% Ni (steel 50N21); 0.025% C, 22.7% Ni, 2.88% Mn (steel N23G3); 0.020% C, 22.4% Ni, and 3.48% Mn (steel N22G3). The effect of NI was evaluated by the change of progress of the martensite curves during cooling of specimens to a temperature of −196°C and heating to a temperature of 20°. The specimens were subjected to NI in the active zone, near the U rods, of an experimental physical heavy-water reactor for periods of 100 and 200 hours. Following the NI the specimens were allowed to age at room temperature. The NI significantly influences the position of the martensite point and over-all T effect; the latter also depends on the type of material in question. In the cases of carbon steels, the NI elevates the martensite point and increases the T effect during deep cooling. In the case of carbon-free alloys, the NI affects austenite in an opposite fashion viz., the martensite point is lowered and the intensity of T during cooling is reduced. In carbon steels, a certain amount of martensite is formed already during the NI process. The manner in which irradiation affects martensite T has much in common with the effect of plastic deformation. The aging of specimens at room temperature results in improved stability of austenite. The poor temperature stability of the activating effect of NI indicates that it is governed by formation of defects of the vacancy interstitial-intrusion type which produce elastic deformations in the crystal lattice. The stabilizing effect of NI is brought about by the formation of defects that are caused by division and disorientation of crystals, as a result of which the chances for the appearance and growth of martensite crystals are diminished.

**11433**
ON THE LAWS GOVERNING THE ELIMINATION OF RADIATION DAMAGE UPON ANNEALING. A SURVEY. O. P. Maksimova and A. I. Zakharov. Sbornik Trudov Inst. Metalloved. i Fiz. Metal. Tsentral. Nauch. Issledovatel. Inst. Chernoĭ Met. 5, 528-49(1958). (Translated from Referat. Zhur. Met. No. 8, 1958, p. 207.)

A review is presented of the laws governing the elimination of radiation damage upon the annealing of metals. The character of and the laws governing the complex modifications of physical and mechanical properties and phase transformations in metals occurring upon irradiation, and the processes and the laws governing the restitution of the initial properties to metals upon annealing were examined together with an analysis of modifications occurring in five temperature ranges.

**11434**
DE INVOLOED VAN DERNSTRALING OP VASTE STOFFEN. (The Effects of Radiation on Solids.) RCN Mededeling Nr. 2, 1957. H. G. van Bueren, A. H. Cottrell, J. Heijboer, and G. Mayer. s'Gravenhage, Netherlands, Reactor Centrum Nederland, 1957. 77p. (In English and Dutch)

A series of four articles is presented on the effects of radiation on solids. Lattice imperfections in crystals are discussed as a general introduction to the characteristic properties of physical point and line imperfections such as can occur in irradiated metallic, ionic, and valence crystals. Ionizing radiations dissipate most of their energy in solids by exciting electrons. The effect of ionizing radiations on organic high polymers is discussed from the fundamental point of view. The effects of fast neutrons on some physical properties of graphite are described. (J.S.R.)

## RADIOACTIVE WASTE

**11435** BNL-4010
Brookhaven National Lab., Upton, N. Y.
PROPORTIONAL SAMPLING OF FLOWING LIQUID WASTES FOR RADIOACTIVE MONITORING. John M. Ruddy. [Apr. 5, 1959]. 16p. Contract [AT-30-2-GEN-16]. $3.30(ph), $2.40(mf) OTS.

The purpose, methods, equipment, and design criteria are described for sampling flows varying from small and intermittent, as at the effluent of a laboratory building, to large and continuous, as at a sewage disposal plant. Data are given for quantities of liquid wastes which might be expected from laboratory buildings. (auth)

**11436** CF-58-7-77
Oak Ridge National Lab., Tenn.
RADIOACTIVE WASTE TREATMENT AND DISPOSAL —A BIBLIOGRAPHY OF UNCLASSIFIED LITERATURE, PART 2. J. O. Blomeke. July 22, 1958. 24p. Contract [W-7405-eng-26]. $4.80(ph), $2.70(mf) OTS.

This bibliography of the unclassified literature on radioactive waste treatment and disposal has been compiled from references published in the Nuclear Science Abstracts, Volume 11, No. 11 (June 15, 1957), through Volume 12, No. 12 (June 30, 1958). The bibliography brings up to date a previous bibliography published as CF 57-8-118. (auth)

**11437** CF-59-1-38
Oak Ridge National Lab., Tenn.
WASTE TREATMENT AND DISPOSAL PROBLEMS OF THE FUTURE NUCLEAR POWER INDUSTRY. F. R. Bruce. Jan. 28, 1959. 15p. Contract [W-7405-eng-26]. $3.30(ph), $2.40(mf) OTS.

The elements of waste treatment and disposal are assessed which are expected to become important in the development of the nuclear power industry of the future. Growth of the nuclear power economy is considered along with composition and quantities of anticipated waste. In addition, the economic implications of waste disposal are considered. It is concluded that research should be concentrated on decontaminating off-gases and on conversion of wastes to a more suitable form than liquid for storage. (J.R.D.)

**11438** CF-59-1-106
Oak Ridge National Lab., Tenn.
NATURE OF RADIOACTIVE WASTES. F. L. Culler, Jr. Jan. 26, 1959. 27p. Contract [W-7405-eng-26]. $4.80 (ph), $2.70(mf) OTS.

The integrated processes of nuclear industry are considered to define the nature of wastes. Processes for recovery and preparation of U and Th fuels produce wastes containing concentrated radioactive materials which present problems of confinement and dispersal. Fundamentals of waste treatment are considered from the standpoint of processes in which radioactive materials become a factor such as naturally occurring feed materials, fission products, and elements produced by parasitic neutron capture. In addition, the origin of concentrated fission product wastes is examined, as well as characteristics of present wastes and the level of fission products in wastes. Also, comments are included on high-level wastes from processes other than solvent extraction, active gaseous wastes, and low- to intermediate-level liquid wastes. (J.R.D.)

**11439** ORNL-2601
Oak Ridge National Lab., Tenn.
RADIOACTIVE WASTE MANAGEMENT AT OAK RIDGE NATIONAL LABORATORY. F. N. Browder, comp. and ed. April 17, 1959. 58p. Contract W-7405-eng-26. $1.75(OTS).

Previously issued as CF-59-1-97.

The collection, treatment, disposal, and monitoring of radioactive wastes (solid, liquid, and gaseous) at Oak Ridge National Laboratory are described in detail. Illustrations of facilities, maps, and tables of data on waste volumes and radionuclides discharged to the environment are included. The philosophy and history of waste management are discussed. The report constitutes an evaluation of waste management at ORNL, concluding that the low degree of radioactive contamination of the air and water by ORNL does not represent a hazard to the local environment or population. (auth)

**11440**
RADIOACTIVE CONTAMINATION OF LAND SPACES BY INSECTS FLYING OUT FROM CONTAMINATED BASINS. A. A. Peredelskii and I. O. Bogatyrev (Inst. of Biological Physics, Academy of Sciences of the USSR, Moscow). Izvest. Akad. Nauk S.S.S.R., Ser. Biol. No. 2, 186-92(1959) Mar.-Apr. (In Russian)

Quantitative species specificity is noted with regard to contamination of the body of adult insects (mosquitoes, ephemera, Trichoptera) with various isotopes, such as $Cs^{137}$, $Sr^{90}$, $Co^{60}$, and non-separated mixture of $\beta$ and $\gamma$ radiating fission products. With an increase in the specific activity of water the activity of adult insects increases. A greater total activity is appropriate to larger insects. Total radioactive contamination of winged insects can become very appreciable over a number of generations each generation consisting of many million individuals. Thus, experimental evidence is brought forward in favor of the hypothesis of bioecological self purification of basins from radioactive contamination followed by contamination of the surrounding land spaces. The actual rates of bioradioecological purification of basins and of increase in the radioactive level of the neighboring land areas are probably still higher due to radioactive faeces of insectivorous birds, the passage from contaminated basins of metamorphosized amphibians to land, where they die, etc. Thus, it will appear that substantial contributions can be made by radioecology (both theoretical and sanitary hygienic) to the problem of burying radioactive wastes and of contamination of nature with radioactive isotopes. (auth)

# REACTORS

## General

**11441** AERE-C/M-270
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
THE EFFECT OF NEUTRON POISONS ON A HIGH-FLUX ENRICHED FUEL, THERMAL REACTOR. G. Long. Mar. 1957. 11p. (HARD(A)/P-9).

General equations which describe the effect of neutron poisons on the reactivity of a high-flux thermal reactor in terms of the macroscopic absorption cross section of the poison are derived, and the effect of poisons on the breeding is considered. As an example these equations are applied to the poisoning of a $U^{233}$–$D_2O$ system by higher isotopes of the fuel. (auth)

**11442** BNL-4124
Brookhaven National Lab., Upton, N. Y.
STORED ENERGY: GROWTH AND ANNEALING STATUS OF GRAPHITE MODERATOR IN THE BNL RESEARCH REACTOR. Final Report. Contains reports BNL-275(Del.) and BNL-255. 225p. $34.80(ph), $9.90(mf) OTS.

The present status, past annealing procedures and experiences, future annealing procedures, annealing schedule, revised annealing procedure (1958), procedure for combating a graphite fire in fuel channel, high-temperature stored energy, and graphite burning experiments are reported for the BNL Research Reactor. The following subjects are discussed in the appendixes: control of radiation damage in a graphite reactor; annealing of graphite moderator structure in the BNL; annealing operation in BNL graphite reactor; effect of pile radiation on mechanical and other properties of graphite; neutron sensing instrumentation; instrumentation for sensing fuel failures; thermocouple pattern for enriched fuel loading; environmental hazard from a molten fuel element; retention of volatile fission products on filters; retention of volatile fission products on water tube coolers; retention of volatile fission products in molten fuel plates; and release of the low-temperature stored energy in the BEPO Pile. (W.L.H.)

**11443** CF-58-10-64
Oak Ridge National Lab., Tenn.
MSPR IN-PILE LOOP ORNL-MTR-44 DESIGN AND OPERATING CONDITIONS. J. A. Conlin. Oct. 20, 1958. 38p. Contract [W-7405-eng-26]. $6.30(ph), $3.00(mf) OTS.

A brief description and the planned operating parameters of the ORNL-MTR-44 MSPR in-pile loop are given together with the operating characteristics of the major components of the loop. (auth)

**11444** CF-59-1-13
Oak Ridge National Lab., Tenn.
FUEL CYCLE COSTS IN A GRAPHITE MODERATED SLIGHTLY ENRICHED FUSED SALT REACTOR. C. E. Guthrie. Jan. 9, 1959. 7p. Contract [W-7405-eng-26]. $1.80(ph), $1.80(mf) OTS.

A fuel cycle economic study has been made for a 315-Mwe graphite-moderated slightly enriched fused-salt reactor. Fuel cycle costs of less than 1.5 mills may be possible for such reactors operating on a ten-year cycle even when the fuel is discarded at the end of the cycle. Recovery of the uranium and plutonium at the end of the cycle reduces the fuel cycle costs to ~1 mill/kwh. Changes in the waste storage cost, reprocessing cost or salt inventory have a relatively minor effect on fuel cycle costs. (auth)

**11445** HW-58016
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
REACTIVITY WORTH AND POWER DISTRIBUTION OF SPIKE LOADING CONFIGURATIONS IN PRTR. R. E. Peterson and J. J. Regimbal. Oct. 31, 1958. 23p. $4.80(ph), $2.70(mf) OTS.

Efficient startup and operation of the Plutonium Recycle Test Reactor depends on accurate forecasts of fuel inventory and placement of fuel in the reactor core. Calculations in the study were carried out using VALPROD, a one-dimensional, multigroup diffusion theory reactor code programmed for the IBM-650 computer. Because of the nature of the machine calculation, only cylindrically symmetric loading patterns could be considered. However, to some extent, these data may be extrapolated to slightly asymmetric configurations. The series of calculations was divided into eight reactor sets. At the present time, it appears that the most probable combination of fuel and reflector for reactor startup will be Mk-1 $UO_2$ fuel, 1.65 wt.% Pu–Al spike with a $D_2O$ reflector. (W.L.H.)

**11446** HW-59373
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
EFFECT OF MODERATOR HEIGHT ON REACTIVITY AND VERTICAL FLUX DISTRIBUTION IN PRTR. J. J. Regimbal. Mar. 3, 1959. 17p. Contract [W-31-109-Eng-52]. $4.80(ph), $2.70(mf) OTS.

A quantitative appraisal of the reactivity effects due to moderator level changes in controlling or scramming the reactor is presented. In addition, an evaluation of vertical flux or power distributions for any positioning of the moderator level is included. The calculations were made using a one-dimensional, multigroup diffusion theory reactor code, programmed for IBM-650. The sensitivity of reactivity to changes in moderator level is less than that given by the results of the modified one-group treatment. The quantitative manner in which any constant maximum specific power limits the immediate reactor power to a certain fraction of the expected equilibrium power for any moderator level is also presented. (J.R.D.)

**11447** HW-59600
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
DIVISION OF REACTOR DEVELOPMENT PROGRAMS MONTHLY REPORT [FOR] FEBRUARY 1959. L. H. McEwen comp. Mar. 15, 1959. 32p. Contract W-31-109-Eng-52. $6.30(ph), $3.00(mf) OTS.

Hydrogen absorption and sintering properties of PWR grade $UO_2$–$PuO_2$ systems were investigated. The induction melting facility for Al–Pu alloy preparation and casting was activated, and Al–U extrusions were made using a 280-ton press. Development is reported in fuel element die casting, as well as progress in Mark I fuel element design engineering. Fabrication of PRTR fuel elements continued with emphasis on quality improvement. Fabrication development included a technique for welding rectangular Zircaloy ribs to Zircaloy sheet. Evaluation of swaged $UO_2$ samples after MTR irradiation is reported. Exploration of ultrasonic agitation for use in Zircaloy etching baths was conducted. Various design tests such as cold PRTR pump performance, test of an injection pump, reactor piping structural integrity tests, and Zr tube burst tests are reported. Design analysis is reported in such areas as PRTR tube design and control instrumentation. Development of plutonium oxalate disk filters was continued, and a method of producing a steady filter pressure drop and volume flow-through is reported. Data on heavy water moderated cluster lattices were correlated, and reasons for discrepancies are given. Nuclear safety in handling PRTR fuel elements was studied, and recommendations for handling equipment modification were made. 6.4 days was established as the discharge interval for spike elements in PRTR. A report on cycle analysis was completed in which the reactivity worth of Pu and U-235 is examined. A single-pass fuel cycle code for IBM-709 was developed and an IBM-650 analysis of effects of varying the composition of Pu feed as well as the special effects of Pu stainless steel cladding is reported. Weight loss studies of graphite $CO_2$ oxidation were continued as well as development of test methods for coated graphite properties determination. Criteria for safe storage of 1.8% U-235 enriched $UO_2$ fuel elements are listed. Theoretical studies to predict values of thermal utilization for various lattice spacings in PCTR were conducted, and modifications for the expressions for use when a control rod is present are being developed. Effects of ultrasonic Lamb waves were explored including investigation of their effects on adhesives and welds. Development of radiant heat spray calcination was continued and runs with an 8-in. design are reported in which the operation technique was aimed at optimizing conditions. Supporting studies in the 3-in. column are also reported. (For preceding period see HW-59179.) (J.R.D.)

**11448** IDO-16489

Phillips Petroleum Co. Atomic Energy Div.,
Idaho Falls, Idaho.

REACTOR PROJECTS BRANCH QUARTERLY PROGRESS REPORT [FOR] APRIL, MAY, JUNE, 1958.
G. O. Bright, ed. Jan. 19, 1959. 141p. Contract AT(10-1)-205. $2.75(OTS).

A series of ramp reactivity addition tests was made with the B-12/64 core, with results indicating that there is no unexpected deviation from results obtained from the A core. Several reactor fuse experiments were performed for Atomics International. The fuses operated quite satisfactorily, and reactivity calculations show that full poison injection was achieved about 40 milliseconds after the fuse was triggered. Compensated reactivity calculations for the B cores show behavior similar to the A core results. Design studies for a pile oscillator mechanism to be used with the Spert I-B cores were completed. Oscillator designs were tested in the reactor. Results show that a mechanism mounted in the core-center cross structure gives adequate performance with regard to wave shape, frequency, and reactivity amplitudes. In analysis of the SPERT III core, tentative values of critical rod positions, rod worths, temperature coefficients, and shutdown worth as functions of temperature were obtained. Direct analog readout of oscillograph traces for use in special cases was accomplished by using a curve-follower in conjunction with the Oscar chart reader. Preliminary studies of analog computers for use with SPERT calculations show that solutions are probably feasible. A conduction boiling model for reactor self-shutdown in the short period region was developed. Predictions by the model were compared with experimental data for several cases under both boiling and subcooled conditions and the agreement found to be generally good. Calculations on the B cores show reactivity values during a transient excursion are only weakly dependent on the power history between the time of breakaway from the exponential and time of peak power. The poison model of reactor shutdown was investigated and appears to offer little promise. Performance tests were made on the SPERT boron chambers. The results indicate they satisfactorily withstood the passage of time, although four out of five were refilled due to a non-linearity with high chamber currents. Drift tests performed on electronic components revealed adequate stability. The procurement and fabrication of the necessary components to convert SPERT I for use with the APPR core were completed. The over-all completion of the SPERT II project is about 55%. The SPERT III project is approximately 98% complete. (For preceding period see IDO-16452.) (auth)

**11449** IDO-16505

Phillips Petroleum Co. Atomic Energy Div., Idaho
Falls, Idaho.

MTR-ETR TECHNICAL BRANCHES QUARTERLY REPORT [FOR] PERIOD ENDING SEPTEMBER 31, 1958. K. A. McCollom, ed. Dec. 30, 1958. 76p. Contract AT(10-1)-205. $2.25(OTS).

MTR Technical Assistance. An experimental study has been made of the operating characteristics of the MTR while fueled with plutonium. Slight modifications to the reactor control system allowed safe operation despite the lower delayed neutron fraction from plutonium. ETR Technical Assistance. Three major loop experiments scheduled for insertion in the ETR have been inserted in the ETRC to study neutron flux and reactivity effects. An experimental comparison has shown the equivalence of the reactivity of boron contained in plastic tape and boron in boric acid for use in the determination of boron in fuel elements. Reactor physics measurements have been made with the same fuel elements and rod positions in both the ETR and ETRC showing that the slightly higher reflector efficiency in the ETRC gives a higher weighting function near the edge of the reactor and a flatter neutron flux distribution than in the ETR. A system has been designed to allow a portion of a chosen shim or safety rod in the ETR to be used as the regulating rod in an on-off servo control. Calculations have been made of the maximum permissible step insertion of reactivity in the ETR for a special case. The gamma heat has been measured at the beginning and end of a cycle and the thermal neutron flux has been measured at three times during a cycle to show their variation in the ETR. Reactor Physics and Engineering. Preliminary out-of-pile heat transfer tests have been started in the nucleate boiling region to provide basic heat transfer data in the convective and subcooled boiling regions and in the burnout regions of fuel elements. A program has been developed to study reaction rates between water and metals below and above their melting points to determine potential hazard to water-cooled nuclear reactors. Studies are proceeding to explain the mechanism of radiation damage in construction materials for testing reactors and their experiments. Two plutonium fuel elements have been hydraulically tested satisfactorily prior to the full core loading in the MTR. The gamma decay dose rates from six fuel elements run in the plutonium loading of the MTR have been followed. Irradiations to 60% burnup have been obtained on the samples in the fuel plate irradiation program. The portion of the capsule irradiation program to study the Gas Cooled Power Reactor fuel element that involves long term prototype irradiations has been undertaken. A self-balancing resistivity instrument in the range of micro-ohms has been developed for detection of resistivity changes in irradiated samples in the MTR hot cell. Experiments performed in the RMF to measure the average poison cross section per fission of fission products have shown that the cross section for Pu-239 is considerably larger than that for U-235. Reactivity measurements on four Savannah River thorium slugs irradiated in the MTR were studied for the fission product transient and the U-233 build-up from Pa-233 decay. The neutron spectrum of a reactor location has been constructed to fair accuracy from three measurements, the thermal flux, the cadmium ratio, and the fast flux. Nuclear Physics. Eta measurements for U-233 from 0.07 to 11 ev are reported. The most probable prompt neutron energies produced by thermal neutron fission of the three isotopes U-233, U-235, and Pu-239 were compared. Simultaneous fission and total cross section measurements are being continued with a view toward further refinements in the multilevel fitting of fission, total and scattering cross sections, and eta measurements of U-233. Total cross sections of Au, B, Y, Np, and Ir were measured. The half-life of Ta-180 was determined to be greater than $10^{11}$ years. The crystal spectrometer was realigned and an accurate energy calibration is being made. Extensive background studies were made on the fast chopper. The construction of an automatic sample changer for the entrance stator of the fast chopper for radioactive samples is nearing completion. A noble gas scintillation fission counter is being built to measure the fission cross section of Pu-241. The phased rotor velocity selector is now in operation and measurements of inelastic scattering of slow neutrons are being made. Resolution, counting rate and background studies were made for the rotors operated by 1800 rpm fixed frequency hysteresis motors. Details of the 1024 channel analyzer under construction are reported. Circuits were developed to reduce oscillations in the phase of the d-c excited salient pole variable speed synchronous motors with respect to the phase of the speed control oscillator. Mass fission yield studies as a function of energy are now underway for Pu-239. Gamma ray assignments to Ba-141 and Ba-142 and a proposed decay scheme for Ba-142 with coincidence and abundance measurements are reported. The beta half-life of Nb-94 was determined to be $(2.03 \pm 0.16) \times 10^4$ years. Measurements designed to give accurate U-235 capture and fission cross sections for a thermal neutron spectrum have been started. The chemical determination of the amount of Hg produced in the neutron irradiation of Au is being studied as a method of monitoring resonance neutron flux for large nvt irradiations. A measurement of the K-shell internal conversion coefficient for the 0.130-Mev isomeric transition in Rh-105 gives a value of 2.3 ± 0.2. A typical pulse height spectrum for a 3 in. × 3 in. NaI (Tl) scintillation detector is given. Theoretical Physics and Mathematic Analysis. Knowledge required of the temperature distribution in a body with distributed heat sources during a transient state has led to the solution for a special case which can be extended to more general cases. Two theorems have been proven to show when a set of coupled linear differential equations with constant coefficients can be solved in terms of an exponential. Several approximations have been studied to speed up the calculations for a set of differential equations, $\dot{x} = Ax$. (For preceding period see IDO-16481.) (auth)

**11450** NAA-SR-Memo-256
North American Aviation, Inc., [Downey, Calif.].
WBNS CRITICAL EXPERIMENT. T. Fahrner.
Mar. 11, 1952. Decl. Feb. 19, 1959. 12p. $3.30(ph), $2.40(mf) OTS.

A program of criticality tests of the WBNS is presented. The assembly component parts are described. (A.C.)

**11451** NAA-SR-Memo-1276
North American Aviation, Inc., Downey, Calif.
KINETICS OF A POOL-TYPE REACTOR WITH STAINLESS STEEL FUEL PLATES. D. L. Hetrick. Mar. 23, 1955. Decl. Nov. 6, 1958. 20p. $3.30(ph), $2.40(mf) OTS.

Recent BORAX experiments indicated the desirability of seeking modifications for pool-type reactors which will reduce the probability of fuel element melting. An investigation was conducted to determine if the replacement of the usual Al—U alloy Al clad fuel plates by stainless steel—$UO_2$ stainless steel clad plates with a higher melting point and thinner cladding would be advantageous. Tests showed that during an excursion, heat conduction by stainless steel plates with 5-mil cladding was comparable to Al plates with 20-mil cladding. The limiting reactivity for meltdown in a BORAX configuration was 2.5% for the stainless steel plates and 2.0% for the Al plates. This advantage disappears when the steel cladding thickness exceeds 8 mils. (D.E.B.)

**11452** NP-7373
Kernreaktor Bau- und Betriebs-Gesellschaft m.b.H.
Institut für Neutronenphysik und Reaktortechnik, Karlsruhe, Germany.
ABSCHIRMPROBLEME DES FR 2. BERICHT NR. 12. (Shielding Problems of the FR-2. Report No. 12.) G. Blässer. Jan. 10, 1959. 34p.

The practical methods for shielding calculations were presented briefly from the viewpoint of their correlation with the transport theory. Methods of gamma and neutron shielding calculations and the calculation of the first collision flux at various geometries were considered. The application of these methods to the interpretation of the side shielding of the FR-2 reactor is given. (J.S.R.)

**11453** NP-7374
Kernreaktor Bau- und Betriebs-Gesellschaft m.b.H.
Institut für Neutronenphysik und Reaktortechnik, Karlsruhe, Germany.
ÜBER DIE WIRKSAMKEIT VON ABSCHALTSTÄBEN THERMISCHER REAKTOREN NACH DER ZWEIGRUPPENTHEORIE. BERICHT NR. 13. (The Effectiveness of Scram Rods of Thermal Reactors from the Two Group Theory. Report No. 13.) R. Fröhlich. Jan. 12, 1959. 40p.

A cylindrical reactor in which a number of scram rod rods are introduced parallel to the axis is considered. For the determination of the reactivity change caused, eigenvalue equations were derived within the framework of the two-group theory for any scram rod configuration. In the case of the scram rod configuration of the FR-2 these equations were evaluated for air charged, $H_2O$ charged, and $D_2O$ charged cadmium rods with dependence on uniform rod radius. For air charged cadmium rods of the FR-2 a remarkable dependence of the effectiveness was detected on the Fermi age of the thermal neutrons. The reactivity changes in the case of a single concentric scram rod were determined with the help of eigenvalue equations, which are exactly valid within the two-group theory. Special attention was given to a comparison of the numerical results with the corresponding results obtained within the one-group theory. (tr-auth)

**11454** RDB(W)/TN-186
United Kingdom Atomic Energy Authority. Industrial Group. Windscale Works, Sellafield, Cubm., England.
AN ENRICHMENT TEST FOR CARTRIDGES AT WINDSCALE. R. R. Gallie and J. Sherwin. Jan. 1955. 16p. (WTSC/R-201).

The experimental results on the various methods investigated are reported, and a test using the attenuation of a sub-cadmium neutron beam on passing through the cartridge is recommended for operational use. The discrimination obtained with this method with a source strength of $10^8$ neutrons per sec and an average counting time of 5 minutes is such that the probability of passing a cartridge with enrichment 10% above normal is 2 in 100, and 2 in 10,000 for an enrichment 20% above normal. (auth)

**11455** REIC-7(Add.)
Battelle Memorial Inst. Radiation Effects Information Center, Columbus, Ohio.
SURVEY OF IRRADIATION FACILITIES (FIRST ADDENDUM). J. F. Kircher and J. L. McFarling. Feb. 15, 1959. 64p. Project No. 2133. Contract AF33(616)-5171. (AD-210767).

Brief descriptions are given of reactor facilities completed in the past years, those under construction, and those in the planning stage. Additional gamma facilities are also listed. (auth)

**11456** WAPD-S5W-RP-49
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
THE WAPD-SPERT-1 EXPERIMENT. E. R. Sanford. July 1956. 49p. $7.80(ph), $3.30(mf) OTS.

In order to determine experimentally the self-shutdown properties of highly-loaded U–Zr plates, a series of transients was conducted in the SPERT-1 reactor. One of the 28 subassemblies comprising the reactor (a central one) was replaced by a specially instrumented subassembly containing 20 wt. % $U^{235}$–Zr fuel plates. The test assembly and the experimental procedure were designed to obtain data on the relative self-shutdown properties of SPERT and of a SPERT-like reactor containing U–Zr fuel. SPERT was subjected to several power transients in the 22 to 400 msec range. Records of transient pressures and temperatures in SPERT and WAPD channels and of reactor power were obtained. It was concluded that a SPERT type of reactor containing the WAPD fuel plates would have better self-shutdown properties than does SPERT-1. Also the peak power reached in a transient of given period would be at least a factor of two less in SPERT-1 with WAPD fuel plates than with the typical SPERT fuel plates. (auth)

**11457** AERE-Lib/Trans-811
FLUX FINE-STRUCTURE IN GAS-COOLED REACTOR CELLS. G. Riesch. Translated by M. C. Hartnell-Beavis (U.K.A.E.A.) from Atomkernenergie 3, 15-21 (1958). 16p.

Newmarch's calculations of fine structure in cylindrical cells with central fuel rods in the channels are extended to clusters of fuel elements. (auth)

**11458** CEA-tr-R-594
POSSIBILITÉ DE CONCEPTION D'UN RÉACTEUR THERMONUCLÉAIRE NON-STATIONNAIRE. (About one Possibility of Unstationary Thermonuclear Reactor.) E. Larisch (Lariche). Translated into French by [B.] Vinogradoff from Atomnaya Energ. 5, 646-7 (1958). 6p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 5466.

**11459**
THE BERLIN RESEARCH REACTOR (BER). E. W. Allen (Hahn-Meitner-Institut für Kernforschung, Berlin); R. Becker and H. Mahlitz (AEG Allgemeine Elektricitäts-Gesellschaft, [Berlin]); W. Dreibrodt (Siemens-Schuckertwerke AG, [Berlin]); and G. Knoerzer (Pintsch Bamag AG, [Berlin]). Atomwirtschaft 4, 94-6(1959) Mar. (In German)

The BER is a water boiler reactor of 50 kw power. The fuel is uranyl sulfate with 20% enrichment in aqueous solution. The cost of the reactor installation is about 2 million DM. The construction of the primary system and shield and the start-up of the reactor are described. (auth)

**11460**
SAFETY PROBLEMS IN THE BER AND THEIR SOLUTION. Wolfgang Jacobi (Hahn-Meitner-Institut für Kernforschung, Berlin). Atomwirtschaft 4, 105-8(1959) Mar. (In German)

In the planning, design, and construction of the BER, safety considerations were of prime importance. The safety of the reactor itself, the reactor building as a safety factor, the control of waste solutions, and the consequences of a theoretical reactor accident are examined. (J.S.R.)

**11461**
THE REACTOR BUILDING AND ITS TECHNICAL ARRANGEMENTS. R. Becker and H. Mahlitz (AEG Allgemeine Elektricitats-Gesellschaft, Berlin); W. Dreibrodt (Siemens-Schuckertwerke AG, Berlin); and L. Schulz (Borsig AG, Berlin). Atomwirtschaft 4, 108-11(1959) Mar. (In German)

The reactor building is a completely enclosed ferroconcrete body with a double skin outer wall. It has smooth plaster on the inside with an adherent coating of welded plastic foil. Special attention was given to the safety problems, especially the ventilation system. The ventilation system in normal operation prevents the escape of radioactive gases or aerosols, but in the case of accidents it can release exact doses. (auth)

**11462**
BUILDING FOR THE EXPERIMENTAL SWIMMING POOL REACTOR OF 3Mw OF THE JUNTA DE ENERGIA NUCLEAR. Santiago Noreña de la Cámara. Energia nuclear (Madrid) 2, No. 8, 5-20(1958) Oct.-Dec. (In Spanish)

The Spanish experimental swimming pool reactor is constructed on the grounds of the Ciudad Universitaria de Madrid. A general layout of the reactor building and its annexes is given, and the reactor building itself is described. The construction of the reactor building and the characteristics of the annex building are discussed. (J.S.R.)

**11463**

THE REACTOR. Oscar Jiménez Reynaldo. Energia nuclear (Madrid) 2, No. 8, 21-31(1958) Oct.-Dec. (In Spanish)

The JEN-1 reactor is a swimming pool reactor using MTR-type fuel elements enriched 20%. The core, its components, the drive mechanisms, support of the ionization chambers, and experimental installations are described. (J.S.R.)

**11464**

INSTALLATIONS OF THE JEN-1 REACTOR. Maria Alicia Crespi González, A. Alonso Santos, R. Faure Benito, and R. Rocher Vaca. Energia nuclear (Madrid) 2, No. 8, 32-51(1958) Oct.-Dec. (In Spanish)

The auxiliary installations of the JEN-1 reactor are described. The cooling system, purification system, drainage, ventilation system, and the electrical installations are considered. (J.S.R.)

**11465**

INSTRUMENTATION OF THE JEN-1 REACTOR. Manuel Quniteiro Blanco. Energia nuclear (Madrid) 2, No. 8, 52-66(1958) Oct.-Dec. (In Spanish)

The instrumentation of the JEN-1 Reactor is described with a consideration of the instruments for nuclear measurements and operation measurements. (J.S.R.)

**11466**

SHIELDING OF THE SWIMMING POOL REACTOR. Alberto Carbo Vila. Energia nuclear (Madrid) 2, No. 8, 67-72(1958) Oct.-Dec. (In Spanish)

The shielding of the JEN-1 reactor is of water in its upper part and water plus concrete for the side protection. The calculations used to determine the height of the water head and the thickness of the concrete are briefly reviewed. (J.S.R.)

**11467**

SAFETY OF THE JEN-1 REACTOR. Fernando Saleta Sanabria. Energia nuclear (Madrid) 2, No. 8, 73-7 (1958) Oct.-Dec. (In Spanish)

The characteristics of the reactor which are related to its safety are reported. No details of the mathematical calculations on which the results are based are given. (J.S.R.)

**11468**

PROTECTION OF PERSONNEL IN THE REACTOR. Eduardo Ramos Rodriguez. Energia nuclear (Madrid) 2, No. 8, 78-90(1958) Oct.-Dec. (In Spanish)

A brief survey is given of the possible dangers from reactor radiation and the methods used to protect the operating personnel against exposure. The alarm systems, portable radiation detectors, and film badges worn by personnel are considered. (J.S.R.)

**11469**

PHYSICAL INVESTIGATION WITH A REACTOR OF THE SWIMMING POOL TYPE. Eduardo Rodríguez Máyquez. Energia nuclear (Madrid) 2, No. 8, 91-6 (1958) Oct.-Dec. (In Spanish)

As examples of the physical investigations which may be made with a swimming pool reactor, studies of the fundamental properties of neutrons, measurements of neutron cross sections, and investigations of the reaction of a neutron with a crystal lattice are discussed. (J.S.R.)

**11470**

POSSIBILITIES WHICH THE REACTOR OF MONCLOA OFFERS WITH RESPECT TO CHEMISTRY. Ricardo Fernandez Cellini, Felipe de la Cruz Castillo, and Germán Dominguez Rodriguez. Energia nuclear (Madrid) 2, No. 8, 97-116(1958) Oct.-Dec. (In Spanish)

The JEN-1 Reactor can be used in chemical research as a source of neutrons and gamma rays, as auxiliary to chemical analyses, for production of radioisotopes, in nuclear chemistry, and in radiation chemistry. (J.S.R.)

**11471**

PROBLEMS IN THE FABRICATION OF FUEL ELEMENTS FOR EXPERIMENTAL WATER COOLED REACTORS. Jose Terraza Martorell, Helios Bergua Gomez, and Manuel Lopez Rodriguez. Energia nuclear (Madrid) 2, No. 8, 117-26(1958) Oct.-Dec. (In Spanish)

The problems in the fabrication of fuel elements, cladding, and quality control are discussed. The possibilities of using the Moncloa reactor as a materials testing reactor are reviewed in an appendix. (J.S.R.)

**11472**

REACTOR PHYSICS FOR THE ELECTRICAL ENGINEER. J. C. James. Nuclear Eng. 4, 170-4(1959) Apr.

In this two part article, a new approach is made to one-group reactor physics. The concept of "buckling" is abandoned in favor of expressions more familiar to the electrical engineer. (W.D.M.)

**11473**

WHAT'S AVAILABLE IN LABORATORY REACTORS? Nuclear Power 4, No. 35, 86-95(1959) Mar.

A guide to the dozen different research reactors available commercially is presented. Characteristics, cost, facilities, etc., are given for Triga II, AGN 201, AGN 211, AGN 451, UTR 10, Jason, Educator, L 77, PTR 604-605, AMF Tank, and AMF Pool. (W.D.M.)

**11474**

EVALUATION OF A BANK OF SLAB-TYPE CONTROL RODS. Robert W. Deutsch (General Nuclear Engineering Corp., Dunedin, Fla.). Nuclear Sci. and Eng. 5, 150-5 (1959) Mar.

A method for evaluating a bank of slab-type control rods in enriched hydrogenous reactors considering both thermal and epithermal capture was developed within the framework of three neutron energy groups. An absorption area technique that combines diffusion theory in the fuel moderator region and a transport condition at the control rod boundary is utilized. The effect of the absorption area is to decrease the source strength for the thermal and epithermal energy groups. The epithermal probability for a non-$1/\nu$ absorber is found by an experimental reactivity comparison to a $1/\nu$ absorber. Assuming that the absorption area is uniformly distributed throughout the core, a hand calculation can be made which determines the number, size, and composition of rods necessary to achieve a specific cold shutdown margin. (auth)

**11475**

RESTRICTED MINIMUM CRITICAL MASS. J. Devooght (Université Libre, Brussels). Nuclear Sci. and Eng. 5, 190-4(1959) Mar.

A continuously varying distribution of fissile material being difficult to realize in a minimum critical mass reactor, restricted distributions varying by steps are investigated in the particular case of "spherical" symmetry. It is shown that the crossing points of the restricted distribution with the unrestricted one are asymptotically distributed like the zeros of the orthogonal polynomials associated with the unrestricted distribution, as weight function. The differences between the minimum masses in the restricted and unrestricted cases are decreasing faster than $4^{-p}$, where p stands for the number of steps of different heights. Other asymptotic properties are examined. (auth)

**11476**
THE INERTIA TRANSIENT IN REACTOR DRAINING. David Burgreen (Nuclear Development Corp. of America, White Plains, N. Y.). Nuclear Sci. and Eng. 5, 200-2(1959) Mar.

The inertia transient in a nonconservative mass and energy system is discussed. The problem of reactor or tank draining is analyzed. The results have application in the design of reactor control or reactor scramming systems which depend upon the drainage of moderator or reflector liquid and may be of use in the evaluation of reactor hazards resulting from the loss of coolant or other reactor liquid. (A.C.)

**11477**
REACTOR-CONTAINMENT ENGINEERING—OUR EXPERIENCE TO DATE. R. N. Bergstrom and W. A. Chittenden (Sargent & Lundy, Chicago). Nucleonics 17, No. 4, 86-93(1959) Apr.

The basic principles are outlined for each stage of reactor containment vessel engineering. Maximum energy release estimation, vessel size and shape selection, structural design, erection and testing, and vessel standardization are considered in some detail. A survey of containment vessels for 18 U. S. and Foreign reactors is included. ASME code rulings for containment vessels are outlined, and the uses of prestressed concrete and underground reactors are discussed. (T.R.H.)

**11478**
GASKETS FOR REACTOR-PLANT SERVICE. Nucleonics 17, No. 4, 128(1959) Apr.

The results are summarized for a literature review and special loop studies to determine leakage of gaskets in pressurized-water systems at high temperatures. (T.R.H.)

**11479**
KERNREACTORTECHNOLOGIE. (Nuclear Reactor Technology.) RCN Mededeling Nr. 4, 1958. H. de Bruyn, M. Bustraan, J. J. Went, H. Wijker, K. H. Dent, J. J. Syrett, J. A. M. Haagh, W. J. Kaufman, K. K. de Jong, J. A. Goedkoop, P. Mostert, J. Goens, and A. H. W. Aten. s'Gravenhage, Netherlands, Reactor Centrum Nederland, 1958. 355p. (In English, Dutch, and French)

A series of articles on nuclear energy is presented. A survey of reactor theory is given, and three reasons for a disturbance of the critical state of a reactor are discussed. The physical processes which form the principles for the calculations on reactor shielding are surveyed. The reactors of the U.K. power program are described. An outline of the implications of physics on reactor fueling is given. The nuclear reactor in chemical technology is discussed. The influence of the coolant pressure and the pressure drop over the steam generators with respect to the heat exchange surface needed to transfer a certain amount of heat is discussed. Reactor vessels for gas-cooled, graphite-moderated reactors is surveyed. The results of six-years' operation of JEEP are presented. The Dutch Materials Testing and Research Reactor is described in detail. A brief description is given of the swimming pool reactor to be built at the University of Delft. A brief historical review is given of the operation of graphite research reactors, and the Belgian Reactor BR-1 is described in detail. The application of research reactors to chemistry is discussed. (J.S.R.)

## Power

**11480** AECU-4073
Duquesne Light Co., Shippingport, Penna.
STATION OUTPUT. SECTION I. Test Results DL-S-210 (T-612387). First issue, Feb. 10, 1959. 15p. $3.30(ph), $2.40(mf) OTS.

The data obtained during the performance of the tests indicate that the station performed satisfactory under the new operating conditions of 500°F average coolant temperature and 1800 psia coolant pressure at the selected power level of 57 Mw. (auth)

**11481** AECU-4078
Duquesne Light Co., Shippingport, Penna.
REACTIVITY LIFETIME. SECTION I. SECOND PERFORMANCE. Test Results DL-S-225 (T-612118A). First Issue, Mar. 4, 1959. 170p. $25.80(ph), $7.80(mf), OTS.

A study was made of the performance characteristics, reliability, stability, and lifetime variations of the PWR Plant and core during steady state conditions at approximately 60 Mw net electrical output. Approximately 60 Mw net was maintained with no safety shutdowns, one safety insertion, and only two flux tilt corrections. The PWR Plant proved to be more stable with four coolant loops in service than it was during the first performance of this test with three loops in service. The PWR Plant operated satisfactorily during the period of this test with no major difficulties. (auth)

**11482** AECU-4079
Duquesne Light Co., Shippingport, Penna.
PERIODIC RADIATION SURVEY. SECTION II. FIRST PERFORMANCE. Test Results DL-S-231 (T-612394). First issue, Mar. 5, 1959. 13p. $3.30(ph), $2.40(mf) OTS.

The radiation level in the Turbine-Governor Service Building, around the Fuel Handling Canal and in the limited access areas of the reactor plant containers during plant operation is determined. All radiation levels were background level readings except for a few points above background located in the walkway areas going from the auxiliary chamber into the reactor chamber, boiler chamber and pressurizer compartment. The only neutrons detected were slow neutrons in the walkway areas from the auxiliary chamber to the reactor and boiler chambers. The radiation levels obtained indicate the areas checked did not present any significant radiation hazard at the time of the test with the plant at 100% power and four main coolant loops in operation after approximately 1950 EFPH. (auth)

**11483** APAE-43(Vol. II)
Alco Products, Inc., Schenectady, N. Y.
APPR-1 RESEARCH AND DEVELOPMENT PROGRAM DECONTAMINATION PROGRAM. TASK II. VOLUME II. EVALUATION OF CHEMICAL AGENTS FOR NUCLEAR REACTOR DECONTAMINATION. John L. Zegger and Guyon P. Pancer. Feb. 15, 1959. 204p. Contract AT(30-3)-326. $22.80(ph), $7.20(mf) OTS.

The caustic permanganate-rinse decontamination treatment was investigated. Loop and metallurgical studies were performed to determine optimum operating conditions as well as the metallurgical effects of the treatment. A treatment with 10% NaOH and 5% potassium permanganate solution followed by a rinse with a 5% ammonium citrate, 2% citric acid and $\frac{1}{2}$% Versene solution was chosen for the decontamination of a stainless steel steam generator. Decontamination factors of greater than 50 were obtained in loop tests using the above treatment. Corrosion and metallurgical results indicated a total penetration of less than 0.01 mil on annealed type 304 stainless steel with no evidence of any deleterious effects. (auth)

**11484** BAW-1038
Babcock and Wilcox Co. Atomic Energy Div., [Lynchburg, Va.].
NUCLEAR MERCHANT SHIP REACTOR PROJECT TECHNICAL PROGRESS REPORT FOR THE PERIOD APRIL 1, 1957–OCTOBER 1, 1957. 65p. Contract AT(30-3)-274. $12.30(ph), $4.50(mf) OTS.

A design study by Babcock and Wilcox Company of a nuclear merchant ship power reactor is presented. The power plant development, reactor system development, and propulsion system development are reported in detail. (W.L.H.)

**11485** CF-58-10-114
Oak Ridge National Lab., Tenn.
HRP-CP: AN EVALUATION OF THE DESIGN FEATURES OF BLANKET PROCESSING LOOP P-1. J. W. Snider and S. D. Clinton. Oct. 22, 1958. 41p. Contract [W-7405-eng-26]. $6.30(ph), $3.00(mf) OTS.

The design features and the performance of $UO_2SO_4$ blanket processing Loop P-1 are evaluated from an engineering viewpoint. This unique experimental development loop was operated with pump heating to study the behavior of plutonium in 1.4 $\underline{M}$ $UO_2SO_4$ at 250°C and was designed for mixed $O_2$–$H_2$ gas pressurization. The canned loop and the feed and sampling systems in glove boxes completely contained the plutonium throughout the experimental program. (auth)

**11486** CF-59-1-60
Oak Ridge National Lab., Tenn.
REQUIREMENTS FOR RAW MATERIALS IN AN EXPANDING NUCLEAR POWER ECONOMY. E. D. Arnold and J. W. Ullmann. Jan. 20, 1959. 38p. Contract [W-7405-eng-26]. $6.30(ph), $3.00(mf) OTS.

Presented at the 1959 American Chemical Society Nuclear Technology Symposium, April 5-10, 1959, Boston.

The need for breeding does not appear to be highly significant in terms of raw materials requirements and cost for a moderately optimistic expanding nuclear power economy between 1960 and 2000. Since the expansion rate of the US nuclear economy is assumed to be high, at least $\frac{2}{3}$ of the U-235 recovered from natural uranium is used to supply reactor inventory. It is the remaining $\frac{1}{3}$ of the available U-235 that can be saved by breeder reactors. The significant variables in comparing two breeders or a breeder and converter are the doubling time and a parameter expressing the total fissile inventory per megawatt of electricity. In fact, the need for new raw material in any given year is reduced more by specific power than by changing from a converter to a breeder. The cost of fuel inventory depends more on the value of total inventory per megawatt of electricity and the content and value of plutonium or U-233 than on raw material cost. The use of 12% vs. 4% annual lease charge can change the inventory costs more significantly than either the Pu (or U-233)/U-235 value ratio or raw material cost. Net fuel burnup costs vary more with the product of net conversion ratio and Pu (or U-233)/U-235 value ratio than with the cost of raw material. (auth)

**11487** CF-59-3-39
Oak Ridge National Lab., Tenn.
TEMPERATURE STRUCTURE IN THE GAS COOLED REACTOR FUEL ELEMENTS USING A SCALLOPED COOLANT CHANNEL. L. G. Epel. Mar. 16, 1959. 11p. Contract [W-7405-eng-26]. $3.30(ph), $2.40(mf) OTS.

An analysis of the temperature structure in the GCR-2 fuel elements and coolant stream at the position where the maximum fuel element surface temperature exists was presented in a previous paper (CF-58-5-97). It was felt that the peripheral temperature variation existing on the fuel rods as brought out in that analysis was due mainly to the poor flow distribution of the coolant with respect to the heat flux. The most expedient way to alleviate this situation without changing the fuel element assembly itself is to scallop the channel so that it becomes, in effect, seven channels merged together to form a single passage. This geometry was studied by use of the IBM 704 digital computer in much the same way the earlier problems were investigated. Since the heat transfer coefficient depends much more strongly on free flow area than on equivalent diameter, the free flow area of the model reported on was made equal to that of the 3.25 in. circular channel so that a comparison of the results of the two configurations would be meaningful. (auth)

**11488** CF-59-3-62
Oak Ridge National Lab., Tenn.
HRT-CHEMICAL PLANT RUN-17 SUMMARY. O. O. Yarbro. Mar. 6, 1959. 19p. Contract [W-7405-eng-26]. $3.30(ph), $2.40(mf) OTS.

The HRT chemical plant hydroclone loop was operated for 829 hr during reactor run 17 and removed 709 g of corrosion product solids from the reactor fuel stream. The composition of corrosion product solids removed averaged 49% Zr, 22% Fe, and 4% Cr, markedly different from solids removed during run 16 which analyzed 51% Fe, 7% Zr, and 5% Cr. The quantity of solids removed by the chemical plant was equivalent to approximately 19% of the stainless steel and 2.5% of the Zr core corrosion products produced in the reactor during run 17. U removed as a solid phase during this run totaled 200 g. Fission products concentrated by the hydroclone included Ru, Zr, Te, Mo, Ce, Y, and Nd. Less than 2% of the I produced by the reactor was found circulating in the reactor fuel, and there was no concentration in the chemical plant. However, other evidence indicated I is held up approximately one day in the high-pressure system compared with a theoretical holdup of about 2 hr if removed quantitively at the letdown rate. (auth)

**11489** DP-345
Du Pont de Nemours (E. I.) & Co. Atomic Energy Div., Wilmington, Del.
HEAVY WATER MODERATED POWER REACTORS QUARTERLY PROGRESS REPORT [FOR] AUGUST, SEPTEMBER, AND OCTOBER 1958. L. Isakoff, comp. Jan. 1959. 60p. Contract AT(07-2)-1. $1.75(OTS).

Cost estimates are reviewed for eight conceptual designs of heavy-water-moderated, natural-uranium-fueled power reactors. Continued progress is reported on the design of the Heavy Water Components Test Reactor (a high temperature irradiation test facility), the construction of a pressurized exponential tank, the fabrication of several power reactor fuel elements, and the irradiation testing of these fuels. Other nuclear, engineering, and materials problems concerning these reactors are also discussed. (For preceding period see DP-315.) (auth)

**11490** GEAP-3088
General Electric Co. Atomic Power Equipment Dept., San Jose, Calif.
22,000 SHP BOILING WATER REACTOR MARINE PROPULSION PLANT FOR A COMMERCIAL TANKER. PRELIMINARY DESIGN. Dec. 1, 1958. 243p. Contract AT(04-3)-196. $3.00(OTS).

A preliminary design is presented for a boiling water reactor power plant for propulsion of a 22,000 SHP commercial tanker. Design features are described. Analyses of the dynamics of the reactor and power plant are presented, including the effects of ship's motion on reactor stability. Preliminary safeguards report, crew training program and plant operating procedures are presented. (auth)

**11491** IDO-24027 and App.
Kaiser Engineers Div., Henry J. Kaiser Co., Oakland, Calif. and Nuclear Products-Erco Div., ACF Industries, Inc., Washington, D. C.
PRELIMINARY DESIGN, 30,000 KW PROTOTYPE PARTIALLY ENRICHED URANIUM, GAS COOLED, GRAPHITE MODERATED NUCLEAR POWER PLANT (PROTOTYPE OF AN OPTIMUM PLANT). (Cover carries title: GAS COOLED POWER REACTOR PRELIMINARY DESIGN, 30,000 KW PROTOTYPE PARTIALLY ENRICHED URANIUM NUCLEAR POWER PLANT.) Report No. 59-3-RE. Mar. 1959. 104p. Appendix. 362p. Contract AT(10-1)-925. (IDO-24027, $2.50(OTS); Appendix $6.00(OTS).)

These two reports were issued separately, but are cataloged as a unit.

Design parameters, preliminary drawings, cost estimates, schedules, safety considerations, and related aspects for a partially enriched-uranium fueled, helium-cooled, graphite-moderated nuclear power plant are presented. The plant is designed as a nominal 30-Mwe prototype of a plant rated at 247 Mwe and optimized for minimum unit power cost. The plant is designed for location at the National Reactor Testing Station in Idaho. It consists of a reactor, steam power plant, shops, warehouses, laboratories, and offices housed in one multipurpose building. (A.C.)

**11492** IDO-24028
Kaiser Engineers Div., Henry J. Kaiser Co., Oakland, Calif. and Nuclear Products-Erco Div., ACF Industries, Inc., Washington, D. C.
OAK RIDGE SITE REPORT 30,000 KW PROTOTYPE PARTIALLY ENRICHED URANIUM GAS COOLED, GRAPHITE MODERATED NUCLEAR POWER PLANT. (Cover carries title: GAS COOLED POWER REACTOR SITE FEASIBILITY, OAK RIDGE, TENNESSEE, 30,000 KW PROTOTYPE PARTIALLY ENRICHED URANIUM NUCLEAR POWER PLANT.) Report No. 59-4-RE. Mar. 1959. 62p. Contract AT(10-1)-925. $2.25(OTS).

A feasibility study and cost estimate are presented for a prototype partially enriched uranium fueled, helium cooled, nuclear power plant modified from an existing Title I design and adapted to a site at Oak Ridge, Tennessee. Adaptation of the 30 Mwe design consists primarily of modifications in the design of the buildings, structures, utilities, and service facilities. Estimated cost of the prototype PEGCPR on this site is $28,700,000. A preliminary reactor hazards evaluation is included. (W.D.M.)

**11493** IDO-24029
Kaiser Engineers Div., Henry J. Kaiser Co., Oakland, Calif. and Nuclear Products-Erco Div., ACF Industries, Inc., Washington, D. C.
SAVANNAH RIVER PROJECT SITE REPORT, 30,000 KW PROTOTYPE PARTIALLY ENRICHED URANIUM GAS COOLED, GRAPHITE MODERATED NUCLEAR POWER PLANT. (Cover carries title: GAS COOLED POWER REACTOR SITE FEASIBILITY, SAVANNAH RIVER PROJECT, AIKEN, SOUTH CAROLINA, 30,000 KW PROTOTYPE PARTIALLY ENRICHED URANIUM NUCLEAR POWER PLANT.) Report No. 59-5-RE. Mar. 1959. 56p. Contract AT(10-1)-925. $2.00(OTS).

A feasibility study and cost estimate are presented for a prototype partially enriched uranium fueled, helium cooled, nuclear power plant modified from an existing Title I design and adapted to a site at the Savannah River Project. Adaptation of the 30 Mwe design to the SRP site consists primarily of modifications in the design of the building, structures, utilities, and service facilities. The estimated cost of the prototype PEGCPR on this site is $28,100,000. (W.D.M.)

**11494** KAPL-1994
Knolls Atomic Power Lab., Schenectady, N. Y.
A MODERATOR-CONTROLLED PRESSURIZED-WATER REACTOR. W. J. Levdahl. Nov. 25, 1958. 17p. Contract W-31-109-Eng-52. $0.75(OTS).

Control of pressurized-water reactors is usually obtained by mechanical insertion of absorbing rods into the core. Ample control may also be provided by varying the leakage of neutrons from the reactor. One promising method of controlling the leakage is to provide void channels in the core and reflector which, when emptied or filled with water, produce changes in the neutron age and geometric buckling. In one high-power-density 80- to 100-Mw reactor based on this concept, the core is conceived as a 67-in.-long, $27\frac{1}{2}$-in.-diam cylinder consisting of annular rows of fuel elements, cooling water channels, and control water channels. The gross water density in each annular region can be individually controlled by completely filling or emptying the control channels within it. The reflector consists of water channels which can be filled or emptied, and the reflector is surrounded by a poison region. A fill tube is connected to each of the 100 or so control channels in the core and reflector; the fill tubes are bundled together and led to one of several hydraulic control units which are seal-welded to the pressure-vessel head. To empty the channel, the control channels are connected by the control units to high-pressure primary-coolant water for filling, or to a cold low-pressure water storage tank. The channel can empty rapidly (scram) by flashing flow when hot; if the reactor is cold, a high-pressure inert-gas system can be used to force water from the tubes. The number of separate control channels may be selected so as to permit the change of reactivity in steps of any desired magnitude. All reflector and core control channels would be empty at cold shutdown and full at peak-xenon override. For normal power operation, at steady-state xenon, only the reflector channels and a few of the outer rows of the core channels would be full.

This nonuniform distribution of moderator results in a rise of the power in the outer core regions and flattening of the radial peak-to-average power to a ratio as low as 1.1 to 1. The axial flux has a cosine distribution with local peaks near the reflector; this results in an axial peak-to-average power of ~1.42. This relatively uniform power distribution permits high specific power without excessive local heat flux. The relatively uniform fuel burnup results in long core life since ~17 kg of the initial 40-kg loading of $U^{235}$ can be consumed before the ability to override maximum xenon at full power is lost. (auth)

**11495** KAPL-M-SSD-37(Rev.1)
Knolls Atomic Power Lab., Schenectady, N. Y.
NEUTRON FLUX AND FUEL DISTRIBUTION MEASUREMENTS; SYSTEM DESIGN DESCRIPTION. J. C. Childs. May 15, 1957. 39p. Contact W-31-109-Eng-52. $7.80(ph), $3.30(mf) OTS.

The design description of the instrumentation system used in obtaining neutron flux and fuel distribution information from within the S3G reactor core is presented. The primary function of this instrumentation is to obtain test data which are relative to the performance of the reactor and which will provide a basis for calculation of fuel burnup history. Equipment designs and operating procedures for S3G application have not been completely determined in some cases. Therefore, certain equipment design details are not included, but will be added in later revisions. (auth)

**11496** MND-1666
Martin Co. Nuclear Div., Baltimore.
A PRELIMINARY EVALUATION OF NUCLEAR THERMOELECTRIC AND THERMIONIC (SECONDARY) POWER PLANTS FOR SPACE USE. Robert J. Harvey, Fred N. Huffman, and C. Eicheldinger. [1958]. 151p.

The unclassified aspects of a preliminary investigation and conceptual design of a thermoelectric and a thermionic space power supply, utilizing reactor heat sources, are summarized. A set of ideal specifications was established as a guide for the investigation of both systems, and various reactor types and concepts were considered. The general design of a space radiator is discussed. The basic theory of both types of generators is reviewed. (W.D.M.)

**11497** NAA-SR-Memo-1008
North American Aviation, Inc., [Downey, Calif.].
A FLUID-FUEL, SOLID-FERTILE MATERIAL ASSEMBLY DESIGN FOR SGR. R. Balent. May 26, 1954. Decl. Mar. 27, 1959. 15p. $3.30(ph), $2.40(mf) OTS.

A preliminary examination of the use of a fluid fuel in the SGR design is made. A system using a solid thorium rod (or hollow cylinder) immersed in a solution of high enrichment uranium—bismuth was investigated. The U—Bi is contained by a steel thimble in the coolant channel of the moderator can of a SGR type reactor. The systems appear to have many attractive features, such as economical processing, unlimited burn-up and increased safety and neutron economy. The advantages and disadvantages of such a system are listed and discussed. It is concluded that the system is worthy of further consideration, and a list of recommended studies is given. (auth)

**11498** NAA-SR-Memo-1077
North American Aviation, Inc., [Downey, Calif.].
EXPONENTIAL EXPERIMENTS PROPOSED FOR THE DETERMINATION OF THE NUCLEAR PARAMETERS OF SODIUM—GRAPHITE LATTICES. R. A. Laubenstein. Aug. 17, 1954. Decl. April 3, 1959. 5p. $1.80 (ph), $1.80(mf) OTS.

The proposed exponential experiments will determine lattice buckling and intra-cell flux distributions for a number of lattices. By correlating the data with theory, the validity of theoretical predictions can be checked and the magnitude and causes of possible discrepancies can be traced. Measurements of additional lattice parameters such as neutron age, thermal diffusion length, and fast effect may also be made, depending on the strength of the neutron source available and the results of other measurements to be made. (A.C.)

**11499** NAA-SR-Memo-1082
North American Aviation, Inc., [Downey, Calif.].
SRE CRITICALITY CALCULATIONS. R. O. Williams, Jr. Oct. 25, 1954. Decl. Nov. 6, 1958. 17p. $3.30 (ph), $2.40(mf) OTS.

The formulas and constants used in calculating the critical enrichment for a hot, clean, equilibrium xenon- and samarium-poisoned 31-cell SRE core are presented. The results of this calculation may be considered somewhat pessimistic since, where uncertanties arose, they were resolved to favor a higher enrichment. This is not to say, however, that there has been a departure from the accepted formulas, rather, it points to the number of judicious choices one must make to perform this type of calculation. The enrichment obtained for the conditions cited is 2.45 atomic percent. It is estimated that this enrichment should be raised to 2.8 at.% to account for control rods, thimbles, safety rods, and burnup. (auth)

**11500** NAA-SR-Memo-1178
North American Aviation, Inc., [Downey, Calif.].
INITIAL TEST OF SODIUM PUMP AND INSTRUMENT LOOP. R. Cygan. Dec. 1, 1954. Decl. Nov. 6, 1958. 35p. $3.30(ph), $2.40(mf) OTS.

An isothermal loop for testing a full-scale sodium pump for SRE and associated instruments has been operated for ~600 hrs. A summary of data obtained, together with recommendations, is given. (auth)

**11501** NAA-SR-Memo-1234
North American Aviation, Inc., [Downey, Calif.].
SRE CONTROL ROD STUDIES AND RELATED SUBJECTS. F. L. Fillmore. Jan. 19, 1955. Decl. Nov. 6, 1958. 30p. $4.80(ph), $2.70(mf) OTS.

A study has been made of several features of the SRE control rods and related subjects. The work is based on the SRE core data which have been recently recalculated and which will be described in detail in a forthcoming report. These data are summarized here for reference purposes. (auth)

**11502** NAA-SR-Memo-1745
Atomics Internal Div., North American Aviation, Inc., Canoga Park, Calif.
HEAT TRANSFER ANALYSIS OF 19-ROD FUEL ELEMENT IN HANDLING CASK. H. L. Sletten. Oct. 9, 1956. 40p. $6.30(ph), $3.00(mf) OTS.

An analysis is made of the surface temperature of the irradiated 19-rod fuel element, which is considered for the SGR type power reactors, in the helium atmosphere of a handling cask. The heat generation rate in the element at the time of reactor shutdown is too high to permit the element to be drawn immediately from the sodium coolant into the cask where the heat is transferred by radiation and natural convection. The fuel element must remain in the sodium for several hours before removal, adding to the total shutdown time for fuel exchange and decreasing the over-all power plant factor. A fuel element decay time on the order of 8 hours after reactor shutdown is required to reduce the heat generation sufficiently to prevent an excessive element temperature in the handling cask. This time is based on a 19-rod element irradiated in a reference SGR, but the time is dependent on several factors. Two strongly dependent factors are the emissivity of the fuel element surface in the cask, and the average load factor (ratio of average operating power to rated power of the reactor). Steady-state energy balance equations for the radiation and convection heat transfer from rods of the element and the cask wall were derived. A simplified model of the fuel element was used to obtain a representation of the radiation interchange between the rods of the element. Solutions of the four simultaneous nonlinear algebraic equations for various values of heat generation and emissivity were obtained by means of the IBM-701 computer. (auth)

**11503** NAA-SR-Memo-1755
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
SODIUM GRAPHITE REACTOR ALTERNATE CORE STUDY—CIRCULAR STAINLESS STEEL CANNED MODERATOR ELEMENTS. J. E. Mahlmeister. Oct. 16, 1956. 46p. $9.30(ph), $3.60(mf) OTS.

The results of a core parameter study of the Sodium Graphite Reactor using circular stainless steel canned moderator elements are presented. The study includes the results of neutron economy evaluations and evaluations of the heat transfer and hydraulic requirements of the SGR core. The method which is given combines the above requirements in such a way to allow the determination of a series of permissible designs for a given reactor power rating and temperature conditions. The evaluated design parameters (enrichment, inventory, slug diameter, etc.) are given as a function of core radius. Recommendations are also given for further studies of the reactor economics and hydraulics to further delineate a specific design. (auth)

**11504** TID-5418
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
PROCESS SPECIFICATION FOR COMPACTION OF NATURAL $UO_2$ FUEL COMPONENTS FOR PWR CORE I BLANKET FUEL RODS. [Mar. 1957]. Decl. Feb. 5, 1959. 6p. (AP-292531). $1.80(ph), $1.80(mf) OTS.

Compaction of agglomerated $UO_2$ powder is the second step in the process of producing $UO_2$ fuel components for the PWR Core I blanket fuel rods. A fuel component is defined as a right cylinder having a length to diameter ratio equal to or less than 1.1. The conditions of compacting are controlled so that the subsequent sintering operation produces consistently high-density compacts. (auth)

**11505** TID-7020(Vol. II, Syst. 35)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
SHIPPINGPORT ATOMIC POWER STATION MANUAL. VOLUME II. [1958]. SYSTEM DESCRIPTION NO. 35: PWR REACTOR PLANT OVERALL CONTROL SYSTEM DESIGN DESCRIPTION. Mar. 10, 1954. Decl. Mar. 19, 1957. 13p. (WAPD-B(C)-1390). $3.30(ph), $2.70(mf) OTS.

Revisions may be issued for this system.

This document and its associated drawing are intended to give information relating to the systems necessary for controlling the pressurized water reactor plant. The systems included are the nuclear instrumentation system, emergency shutdown system, start-up and safety rod control system, chemical control system, primary plant control system, reactor power and temperature control system, and primary plant instrumentation system. The requirements of each system, the method of accomplishment, and the necessary instrumentation for the system are described. The purpose of the document is to establish a single source of information relating to the requirements and functions of all of the control systems of the primary plant, including the reactor. As information on the material covered becomes more specific, the document will be revised to incorporate the changes. (auth)

**11506** WAPD-CDA(I)-7
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
PWR FAILED ELEMENT DETECTION AND LOCATION SYSTEM. H. H. Vogel. Aug. 23, 1957. 3p. $1.80(ph), $1.80(mf) OTS.

The status of the PWR failed element detection and location system was re-examined. It appears that the FEDAL system will be unable to detect or locate a single X-1-L type defect (0.005 in. hole) in an average power $UO_2$ rod in the presence of 1 ppm uranium in the zirconium. It could, however, locate an assembly that contains multiple defects of the X-1-L type. The system can probably detect and locate single failures that have appreciably greater rates of release of fission products than the X-1-L type or appreciably larger holes in the cladding. While the results of this investigation are not encouraging for the detection and location of small failures, the PWR FEDAL system still represents the best now available for Core 1. (A.C.)

**11507** WAPD-PA-64
[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh].
CONSIDERATIONS FOR THE DESIGN CRITERIA OF THE PWR WASTE DISPOSAL SYSTEM. Dec. 14, 1954. Decl. Oct. 24, 1958. 9p. Contract AT-11-1-GEN-14. $1.80(ph), $1.80(mf) OTS.

The basis of estimates for PWR waste disposal design criteria is presented. In addition, effects of the estimates and investigations being carried out to verify the data or furnish new data are considered. The major items which have to be resolved before verification of design criteria are listed, as well as other areas of question. (J.R.D.)

**11508** WAPD-PWR-TE-6
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
DETERMINATION OF PRIMARY SYSTEM PRESSURE DROP. Test Evaluation DL-S-147 (T-550129) Period V—Periodic. D. J. McDonald. Sept. 19, 1958. 25p. $4.80(ph), $2.70(mf) OTS.

A test was conducted to determine the pressure drop and flow characteristics of the PWR reactor coolant system with the plant comparatively clean. Results are analyzed, and calculation of pressure drop in the heat exchangers is outlined. Conclusions are included. (J.R.D.)

**11509** WAPD-PWR-TE-32
Westinghouse Electric Corp. Bettis Atomic Power Div., Pittsburgh.
VALVE OPERATING SYSTEM DRIFT TEST. Test Evaluation DL-S-200 (T-641109). Period II. D. J. McDonald. Oct. 17, 1958. 24p. PWR Project. $4.80 (ph), $2.70(mf) OTS.

A test was conducted to determine the cause of instances in which the positions of one or more reactor coolant loop main hydraulic valves was disturbed during the operation of other hydraulic valves and to develop corrective action. It was found that excessive leakage through the three-way selector valves can cause fail-as-is- hydraulic valves, resulting in drift from their positions. Leakage causes were found and a correction program initiated. In addition, causes of drift in the FEDAL system hydraulic valve and the pressurizer spray line hydraulic valves were determined. Remedial action for use in the PWR is outlined, and design changes for future valves of the same type are recommended. (J.R.D.)

**11510** WAPD-PWR-TE-39
Westinghouse Electric Corp. Bettis Atomic Power Div., Pittsburgh.
DETERMINATION OF EFFECTIVE NEUTRON FLUX FOR PRODUCTION OF TRITIUM FROM LiOH IN PWR PRIMARY COOLANT. P. Frank. [Feb. 1959]. 10p. $1.80(ph), $1.80(mf) OTS.

The effective neutron flux for production of tritium from LiOH in the PWR primary coolant was calculated. Reactor tests were conducted which confirm the method of calculation. It then follows that previous analysis and calculations on waste disposal limitation and container air hazards are confirmed. (J.R.D.)

**11511**
PROCESS HEAT FROM NUCLEAR REACTORS. Harry Perry (Bureau of Mines, Washington) and James P. McGee (Bureau of Mines, Morgantown, W. Va.). Chem. Eng. 66, No. 4, 143-6(1959) Feb. 23.

The comparative economics of the use of nuclear energy versus conventional fuels were considered for supplying process heat to be applied in reforming methane to hydrogen, coal gasification, low-temperature carbonization of coal, ferrous and nonferrous metallurgy, petroleum refining, production of acetylene, and the direct fixation of nitrogen. Price schedules are deduced at which the nuclear power must be produced in order to be competitive with conventional fuels, and various aspects relating to its use are discussed. An appraisal of the present status of high-temperature reactors, which might be used for process heating, is presented, along with an outline of a feasibility study which is being carried on by the joint effort of AEC and Bureau of Mines for an indirect process cycle reactor. Unsolved problems are considered. (J.R.D.)

**11512**
FUEL FOR THE ATOMIC ENGINE. B. Lustman (Westinghouse Electric Corp., Pittsburgh). Metal Progr. 75, No. 4, 72-8(1959) Apr.

The suitability of the material and the fabrication methods of the Shippingport Pressurized Water Reactor (PWR) fuel are described. The PWR fuel consists of long metallic elements of highly enriched U, arranged in a hollow square which encloses and is surrounded by a blanket of natural $UO_2$. (W.L.H.)

**11513**
FLOWABLE SOLIDS REACTOR. M. R. Dusbabek (Fluor Corp., Ltd., Los Angeles). Nucleonics 17 No. 4, 132-6(1959) Apr.

The Flowable Solids Reactor is briefly described and discussed as to its primary system, fuel cycle, and design uncertainties. (T.R.H.)

**11514**
NUTZENERGIE AUS ATOMKERNEN. EINFÜHRUNG IN PHYSIK UND TECHNIK VON KERNREAKTOR UND ATOMKRAFTWERK. BAND I. (Useful Energy from Atomic Nuclei. Introduction to the Physics and Technology of Nuclear Reactors and Atomic Power Plants. Volume 1.) Karl Rudolf Schmidt. Berlin, Walter de Gruyter & Co., 1959. 605p.

A discussion of the fundamentals of nuclear physics serves as an introduction to the physics and technology of reactors and nuclear power plants. The elementary particle, general properties of atomic nuclei, radioactivity, nuclear reactions, structure of the nucleus, special endothermic and exothermic nuclear reactions, and chain reactions are considered in the review of physics fundamentals. The structure of reactors and elementary reactor theory are discussed in the section on reactors. The properties and uses of structural and operating materials are considered. The transfer, discharge, and use of heat produced in thermal power plants are discussed, as well as the apparatus and machines and the thermodynamics of the complete process. The special chemical problems produced by nuclear power plants are reviewed with a consideration of the atomic structure and periodic system, chemistry of the actinides, and preparation of fissionable elements. (J.S.R.)

# TECHNOLOGY

## Feed Materials

**11515** RFP-133
Dow Chemical Co. Rocky Flats Plant, Denver.
AMMONIUM DIURANATE PRECIPITATION WITH ANHYDROUS AMMONIA. Work done prior to: December 18, 1956. L. C. Farrell and L. F. Grill. Mar. 2, 1959. 13p. Contract AT(29-1)-1106. $0.50(OTS).

Ammonium diuranate has been precipitated from nitric acid solutions by the addition of anhydrous ammonia on both laboratory and production scales. This process produced more dense and more rapidly filtered precipitates than those formed by the addition of aqueous ammonia or slurried calcium hydroxide. The filtrates from the anhydrous ammonia process were lower in uranium content than those obtained by the addition of the other reagents. Processing equipment and precipitate characteristics are discussed. (auth)

## Raw Materials

**11516** DOW-159
Dow Chemical Co. Western Div., Pittsburgh, Calif.
NEW METHODS FOR THE PRODUCTION OF HIGH-PURITY URANIUM SALTS. David A. Ellis, Ray S. Long, and James E. Magner. Aug. 1, 1957. Decl. Mar. 24, 1959. 82p. Contract AT-30-1-GEN-236. $12.30(ph), $4.50(mf) OTS.

A study of the preparation of high-purity $UF_4$ by solvent extraction and ion exchange of various process solutions encountered in concentrate mills is presented. (auth)

**11517** RMO-2683
Nevada. Univ., Reno. Mackay School of Mines.
PHYSICAL BENEFICIATION OF LOW-GRADE URANIUM ORES. John N. Butler. July 30, 1958. 129p. Contract AT(49-1)-624. (UN-TR-8). $2.75(OTS).

Investigations are presented of methods for the physical beneficiation of low-grade and other uranium ores. The investigations which have been in progress since September 1952 cover work done on a variety of natural ores, as well as a certain amount of basic research on mixtures of synthetic or high-grade natural uranium minerals with various gangues. Methods of beneficiation investigated include flotation, wet and dry attritioning, magnetic separation, electrostatic separation, and miscellaneous minor methods. A rapid, routine method of colorimetric determination of uranium was also developed in order to facilitate analyzing of low-grade materials for uranium. This procedure is presented in condensed form. (auth)

**11518** WIN-111
National Lead Co., Inc. Raw Materials Development Lab., Winchester, Mass.
SECOND INTERIM REPORT ON INVESTIGATIONS INTO THE PROBLEM OF RADIOACTIVE POLLUTION OF URANIUM MILL EFFLUENTS. M. A. DeSesa, comp. and ed. Apr. 1, 1959. 76p. Contract AT(49-6)-924. $12.30(ph), $4.50(mf) OTS.

In the search for new decontamination reagents, which might supplement or even replace the materials and techniques already developed, several new reagents were examined. It was shown that when water is softened by a cation exchange process, radium is removed from the water and concentrated in the solution used to regenerate the resin column. Investigations were made into the variables involved in the removal of radium with barite. The process for removal of radium by percolation of the tailings through a bed of barite was thoroughly investigated. It was shown that radium adsorbed onto a column of barite could be removed by percolation of water through the column. Work on the use of flocculating and coagulating agents for the clarification of alkaline tailings prior to barite treatment indicated that two-stage or stepwise clarification with copperas not only provided a clear liquor for further treatment but also provided a major decontamination. It was demonstrated that it is feasible to fluorometrically analyze filter paper samples containing ore and concentrate dust for U. A method for the radiochemical determination of Th is presented in detail. (W.L.H.)

**11519**
RECOVERY OF THORIUM. A. Audsley and R. W. Blundell, and U. K. Atomic Energy Authority. British Patent 801,573. Nuclear Eng. 4, 188(1959) Apr.

Aqueous sulfuric acid solutions containing thorium, rare earths, and phosphate can be obtained by heating monazite with concentrated sulfuric acid, diluting the cooled reaction product with water, and separating the insoluble residue from the supernatant thorium-containing solution. From the latter solution the thorium is recovered by introducing ammonium into the solution, increasing its pH value to a maximum of 0.6. As a result the rare earth is deposited in the form of ammonium rare earth double sulfates. The sulfates are then separated from the solution, and the acidity is reduced (by adding ammonia solution) in order to precipitate thorium phosphate.

# DEPOSITORIES OF USAEC REPORTS IN LIBRARIES OUTSIDE THE U.S.

The libraries listed below maintain collections of unclassified U. S. Atomic Energy Commission reports for reference use.

**ARGENTINA**
Buenos Aires, Comisión Nacional de Energía Atómica

**AUSTRALIA**
Canberra, Australian National Library
Sutherland, New South Wales, Australian Atomic Energy Commission

**AUSTRIA**
Vienna, Institut für Radiumforschung der Oesterreichischen Akademie der Wissenschaften
Vienna, International Atomic Energy Agency

**BELGIUM**
Brussels, Centre d'Etudes pour les Applications de l'Energie Nucléaire
Brussels, La Bibliotheque EURATOM

**BRAZIL**
Rio de Janeiro, Instituto Brasileiro de Bibliografia e Documentacao

**BURMA**
Rangoon, Union of Burma Applied Research Institute

**CANADA**
Ottawa, National Research Council Library

**CEYLON**
Colombo, University of Ceylon

**CHILE**
Santiago, Ministerio de Relaciones Exteriores

**CHINA**
Hsinchu, Formosa, National Tsing Hus University Library

**COLOMBIA**
Bogotá, Comision de Energia Atomica de Columbia

**COSTA RICA**
San Pedro, University of Costa Rica Library

**CUBA**
Havana, Comisión de Energía Nuclear de Cuba

**DENMARK**
Risö, Danish Atomic Energy Commission

**DOMINICAN REPUBLIC**
Ciudad Trujillo, National Palace

**EGYPT**
Cairo, Atomic Energy Commission

**ENGLAND**
Birmingham, Central Library
Bristol, Central Library
Kingston upon Hull, Central Library
Leeds, Central Library
Liverpool, Central Library
London, Central Library, Acton
London, Science Museum Library, South Kensington
Manchester, Central Library
Newcastle upon Tyne, Central Library
Nottingham, Public Libraries
Sheffield, Central Library

**FINLAND**
Helsinki, Teknillisen Korkeakoulun Kirjasto

**FRANCE**
Gif-sur-Yvette, Centre d'Etudes Nucléaires de Saclay
Paris, Organization for European Cooperation, Nuclear Energy Library

**GERMANY**
Berlin, Institut für Kernforschung Berlin
Frankfurt/Main, Gmelin-Institut
Munich, Technische Hochschule, Bibliothek

**GREECE**
Athens, Greek Atomic Energy Commission

**GUATEMALA**
Guatemala Comisión Nacional de Enérgia Nuclear

**HAITI**
Port au Prince, University of Haiti

**ICELAND**
Reykjavik, University of Iceland, Atomic Energy Library

**INDIA**
Bombay, Department of Atomic Energy

**IRAQ**
Baghdad, The Ministry of Development, Atomic Energy Division

**IRELAND**
Dublin, University College

**ISRAEL**
Tel Aviv, Israel Atomic Energy Commission

**ITALY**
Rome, Comitato Nazionale per le Ricerche Nucleari

**JAPAN**
Tokyo, Science Section, Diet Library

**KOREA**
Seoul, Atomic Energy Commission, c/o Ministry of Education

**LEBANON**
Beirut, American University

**LUXEMBOURG**
Luxembourg, Ministry of Transport and Electricity

**MEXICO**
Mexico, D.F., Comisión Nacional de Energía Nuclear

**NETHERLANDS**
The Hague, Reactor Centrum Nederland

**NEW ZEALAND**
Wellington, Department of Scientific and Industrial Research

**NORTHERN IRELAND**
Belfast, Department of Industrial and Forensic Science

**NORWAY**
Lilleström, Institutt for Atomenergi

**PAKISTAN**
Karachi, Atomic Energy Commission

**PERU**
Lima, Biblioteca Nacional

**PHILIPPINE REPUBLIC**
Manila, Philippine Atomic Energy Commission

**PORTUGAL**
Lisbon, Junta de Energía Nuclear

**SCOTLAND**
Glasgow, Mitchell Library

**SPAIN**
Madrid, Junta de Energía Nuclear

**SWEDEN**
Stockholm, Atomenergi AB

**SWITZERLAND**
Geneva, United Nations Library
Zurich, Institut für Physik, Eidg. Technische Hochschule

**THAILAND**
Bangkok, Office of the Thai Atomic Energy Commission, Department of Science

**TURKEY**
Ankara, Turkish Atomic Energy Commission, Atomic Energy Library

**UNION OF SOUTH AFRICA**
Pretoria, Atomic Energy Board Library, Council for Scientific and Industrial Research

**UNITED NATIONS**
New York, N. Y., U.N. Headquarters

**URUGUAY**
Montevideo, Universidad de Montevideo

**VENEZUELA**
Caracas, Instituto Venezolano de Investigaciones Cientificas

**YUGOSLAVIA**
Belgrade, Federal Nuclear Energy Commission

THE UNIVERSITY OF ILLINOIS LIBY
CHICAGO UNDERGRADUATE DIVISION
MRS CALLIE B DEAN, SERIALS
ACQUISITIONS DEPT, NAVY PIER
1751 CHICAGO 11 ILL

UNITED S
GOVERNMENT PRINTING OFFICE
DIVISION OF PUBLIC DOCUMENTS
WASHINGTON 25, D. C.

OFFICIAL BUSINESS

PENALTY FOR PRIVATE USE TO AVOID
PAYMENT OF POSTAGE, $300
(GPO)

# TECHNICAL PROGRESS REVIEWS

The U. S. Atomic Energy Commission, Technical Information Service, publishes an unclassified series of Technical Progress Reviews which provide concise summaries of current atomic developments. Issued quarterly, each of these Technical Progress Reviews digests and evaluates the latest findings in a specific area of nuclear technology and science. The Reviews also report on technology developed in military reactor and other classified AEC programs to the extent that the technology can be dissociated from sensitive military and production data.

The three journals currently published in this series are:

*Power Reactor Technology*, Walter H. Zinn and associates, General Nuclear Engineering Corporation

*Reactor Fuel Processing*, Stephen Lawroski and associates, Chemical Engineering Division, Argonne National Laboratory

*Reactor Core Materials* (covering solid material developments), R. W. Dayton, E. M. Simons, and associates, Battelle Memorial Institute

Each journal may be purchased by subscription (domestic, $2.00 a year; foreign, $2.50 a year) or by individual issue (55¢) from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.